

# FLIGHT

*The*  
AIRCRAFT ENGINEER  
AND AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 1318. (Vol. XXVI.) 26th Year.  
No. 13.

MARCH 29, 1934

Weekly, Price 6d.  
Post Free, 7½d. Abroad, 8d.

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C.2

Telephone (2 lines), Holborn 3211 and 1884.

Telegrams: Truditor, Westcent, London.

Subscription Rates, Post Free.					
UNITED KINGDOM			OTHER COUNTRIES		
	s.	d.		s.	d.
3 Months ..	8	3	3 Months ..	8	9
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## EDITORIAL COMMENT



IN our last issue we published large extracts from a paper read before the Rotary Club of Bombay by Mr. N. Vintcent, manager of the Tata Air Lines. The Tata service from Karachi to Bombay and Madras has been running for nearly 18 months, and it has achieved the wonderful record of 100 per cent. efficiency in running to schedule. This experience is certainly not very long, compared with the records of Imperial Airways, West Australian Airways, and Qantas, but still is sufficient to give Mr. Vintcent a right to be heard with attention when he speaks on air-line policy. It should also be remembered that his experience of commercial flying has not been confined to that very successful 18 months. He was once a pilot of the Air Survey Co., and then the business acumen of the Tata firm had been devoted to the study of the question for a couple of years or more before the air line began to operate. That it began to show profits, as Mr. Vintcent told his hearers, after little more than a year's working confirms the wisdom of the planning. Therefore the opinions of Mr. Vintcent are valuable.

He divided air transport into two categories, one that is directly subsidised by a State, and the other which is paid for services rendered. He gave it as his opinion that direct subsidies, although necessary in the early days, have now become undesirable. He compared a company in receipt of a direct subsidy to a child left among quantities of easily obtainable food—he need not, in fact, have confined the simile to a child—and said that both were apt to become lazy. On the other hand, an organisation existing upon payment for the services it renders to the public has a strong incentive to increase its efficiency to obtain a greater volume of business. He considered that the best method of building up an efficient system of air transport by a Government was by granting air mail contracts and by providing every modern aid to safe flying. His only criticism of the Government of India was, not that it had refused to grant any subsidies, which he called a wise refusal, but that it had not provided

### DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

- 1934.
- Apr. 5. "Engines." Lecture by Capt. A. G. Forsyth before R.Ae.S.
  - Apr. 7-10. Forum Club Aviation Exhibition.
  - Apr. 12. "Speed and the Future of Commercial Aircraft." Lecture by M. Louis Breguet before R.Ae.S.
  - Apr. 16, 23, 30. "Gyroscopes." Series of Lectures by Prof. J. G. Gray before Royal Society of Arts.
  - Apr. 22. Northamptonshire Ae.C. Tea Party and Opening of New Club Buildings.
  - Apr. 23-27. 35th International Aviation Conference, Geneva.
  - Apr. 26. "Landing in Fog." Lecture by Dr. Rüd Stüssel before R.Ae.S.
  - Apr. 27-May 6. International Aero Show, Geneva.
  - May. Wilbur Wright Memorial Lecture, before R.Ae.S.
  - May 17-June 2. Royal Tournament, Olympia.
  - May 21. Guild of Air Pilots Garden Party.
  - May 24. Empire Air Day.
  - May 26. Heston Air Navigation Trials.
  - May 27. Deutsch de la Meurthe Cup.
  - June 1. Entries close at 12 noon for London-Melbourne Race.
  - June 2. Brooklands Air Race Meeting.
  - June 3. London Aeroplane Club Garden Party, Hatfield.
  - June 9. Reading Ae.C. Annual "At Home."
  - June 16. R.A.F. Reserve Flying Club Annual Flying Display, Hatfield.
  - June 23. Lancashire Ae.C. Air Display, Woodford.
  - June 30. Royal Air Force Display, Hendon.
  - July 3-9. 4th International Congress for Applied Mechanics, Cambridge.
  - July 7. Opening of Leicester Airport.
  - July 8. French International 12 Hours' Reliability Trial.
  - July 13-14. King's Cup Race. Start and finish at Hatfield.
  - July 21-22. French Grand Prix.
  - July 28. Bristol and Wessex Ae.C. Garden Party.
  - July 29. London-Sherburn Race (York County Aviation Club).
  - Aug. 11. London-Newcastle Race (Newcastle-on-Tyne Ae.C.).

enough landing grounds and meteorological services on the Karachi-Madras route. It should be kept in mind that the Tata Air Lines carry only mails and do not accept passengers. It is also interesting to note that, when discussing the proposed air service between Calcutta and Bombay, Mr. Vintcent said that it was the considered opinion of his firm that the route should be inaugurated with high-speed mail carriers, but that later on mails and passengers would be carried together in larger machines flying to the same schedule, if not faster.

It is interesting to compare the views of Mr. Vintcent with those of Mr. Woods Humphery as expressed in an article in *The Times* not very long ago. Of course conditions are not the same. Imperial Airways run services which take many days of travel, and sleeping accommodation at night has to be provided on the ground. Comfort then becomes a matter of primary importance, and until quite lately Imperial Airways seem to have regarded speed as of secondary importance. Their speed-up, announced since the appearance of Mr. Woods Humphery's article, is a sign of grace. It is evident from that article that the managing director of Imperial Airways is not at all keen on the idea of running fast mail-carriers, though he admits that there would be no difficulty in doing so if the Government would pay the cost. It has always seemed to us that it is highly legitimate for a Government to spend public money on securing speedy transport of mails, even though the Post Office balance-sheet should show a loss on the operation. The public would get its money back from the advantage to commerce in general. We also incline to the opinion that a Post Office contract, with generous terms but severe penalties for late delivery, such as has for long been granted to shipping companies, and have also been granted to air transport companies by the Government of Canada and other countries, are the best means of securing rapid delivery of mails.

Mr. Woods Humphery, however, sets forth his belief that if passenger transport and mail transport are separated, the passengers will suffer. He says that the services for them will be less frequent and that smaller and less economic aircraft will be provided for them. The passengers will be less comfortable, and so it is to be expected that some of them will leave Imperial Airways and travel either by foreign air lines or by train and steamer. Surely this is an unduly pessimistic forecast! It seems to overlook the possibility that air passengers will so increase in number that in no long time they will by themselves occupy the full seating capacity even in large aeroplanes. Then if the machines really justify the term economic, the service will pay even without the assistance of mails. Sir Philip Sassoon stated in the House of Commons the other day that since 1929 the number of passengers carried by Imperial Airways had increased by 90 per cent. There is every reason to anticipate a much more rapid increase in the coming years, for flying is growing steadily more popular, while machines are becoming every year more economic. That passengers might conceivably suffer in comfort and so give up flying does not seem to us at all a convincing reason for refraining from sending mails by fast special aeroplanes.

One obvious way of increasing the speed of air transport is to institute night flying. This, however, must apply to mails rather than to passengers.

Machines have been made with sleeping accommodation in them, but obviously a passenger takes up more room when lying down than when sitting up, and so it would be impossible to carry the full complement of passengers when berths took the place of chairs. Mails, on the other hand, will certainly be flown through the night when air transport systems are fully developed. The preparation of night routes is only a matter of money, and as progress takes place this money will certainly be found. In fact the future of the special fast mail-carrying aeroplane appears to be assured, and it seems hardly good policy to draw gloomy pictures of the possible bad effect which it will have on passengers when the separation of the two classes of air cargo comes to pass.

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Railway-Air Services, Ltd., the new company which has been formed by the four leading air lines and Imperial Airways, shows signs of activity. Although no definite policy has been decided upon

by the directors, some anticipations of what they may do have been published. **Railway Air Services, Ltd.** and these wear an air of inspiration.

Even though they may not be accurate in all details of what lines the company intends to start, they may probably be taken as showing that this new company does not intend merely to ward off competition from the air, but means to use air transport actively itself in conjunction with the services of the railway companies on rail, sea, and road. Until the actual programme has been passed and published, it would be useless to say more than that, or to comment on the lines which are to be started. Some general remarks may, however, be permitted.

If Railway-Air Services, Ltd., had undertaken a policy of killing outside competition from independent air companies, without trying themselves to make a reality of air transport, everyone would have agreed that the formation of this company was a public disaster. As the company seems, on the contrary, to be planning real activity in promoting air transport, it is only logical to welcome this development with thankfulness. There is no doubt of the resources behind the company, or of the experience in running commercial air services which Imperial Airways can contribute. All the essentials are there which should go towards providing Great Britain and Ulster with a really useful series of air lines. All who think only of the interests of air transport must rejoice at the prospect now laid before them.

At the same time it is only human to feel strong sympathy with a number of enterprising persons who have sportingly started private air lines, some of which undoubtedly are sound in conception and in organisation. It is, of course, doubtful whether any of them could easily survive deliberate rivalry by such a powerful concern as Railway-Air Services. Some of these companies have, by their success, won a definite goodwill, which should be a bargaining asset, and it is to be hoped that where the new powerful company feels it necessary to control a certain route, it will be ready to negotiate with the pioneer, rather than to declare war *à outrance*. Other private companies have done less well, and a fiasco by a badly equipped air company does harm to the cause. If Railway-Air Services abolishes fiascos, it will do good rather than harm to all commercial flying.





## THE SUPERMARINE "SEAGULL" MARK V

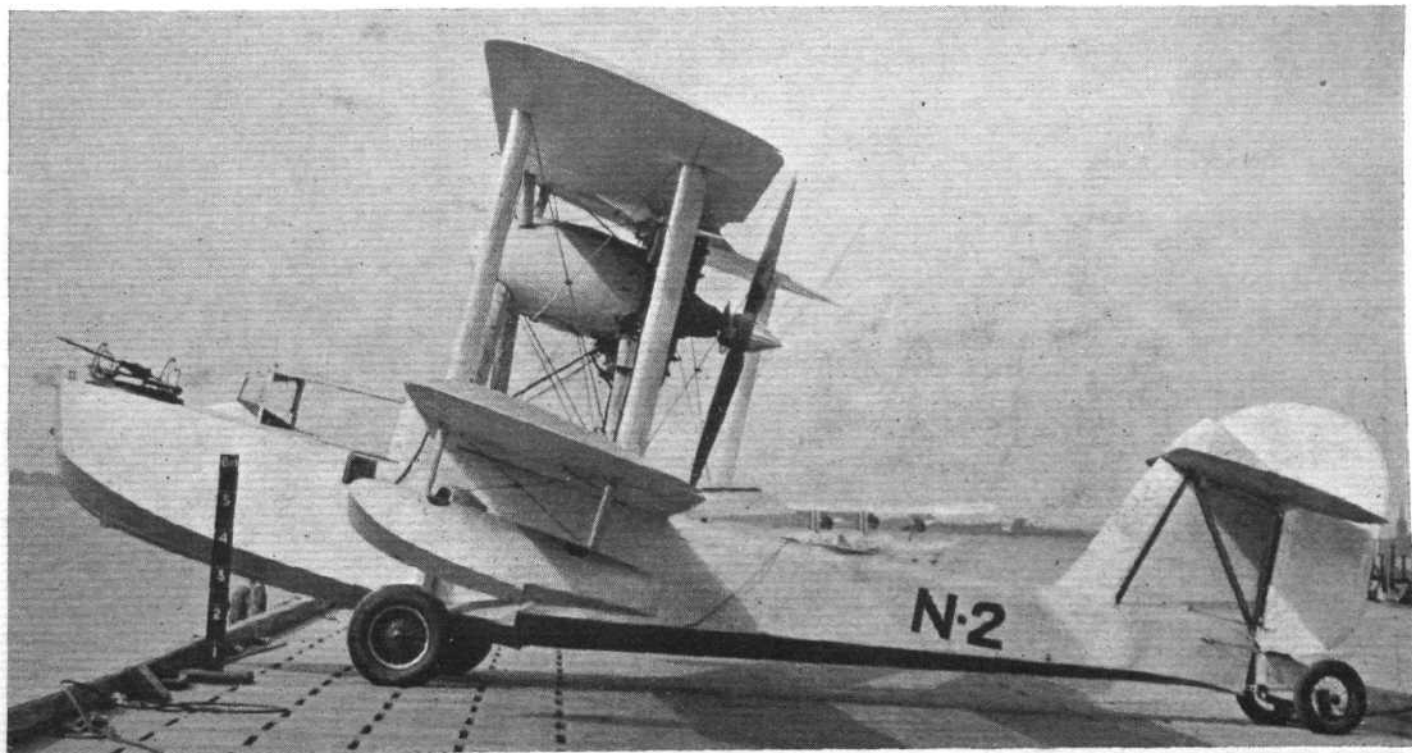
Bristol "Pegasus" Engine

**W**HEN the Society of British Aircraft Constructors held its Display at Hendon in July last year, on the Monday after the R.A.F. Display, one of the machines which attracted great attention was an entirely new type produced by the Supermarine Aviation Works. The machine made its first public appearance on that occasion, having in fact been finished but a few days previously, and the flight to Hendon being its third. In spite of this, Mr. Summers, Vickers' test pilot, handled the machine remarkably well, and caused favourable comment by his demonstration of its capabilities. The machine was known as the "Seagull" Mark V, and was fitted with a Bristol "Pegasus" engine so mounted as to drive a "pusher" airscrew.

Since last summer a great deal of development work has been done on the new machine, and it has now reached a stage when it can be considered quite ready, for production work to begin. In addition to such features as amphibian undercarriage and pusher airscrew drive with an air-cooled engine, the "Seagull" Mk. V is remarkable in that it has been strengthened to stand successfully the large stresses caused by launching the machine by catapult. We believe that many years ago an old flying boat was catapulted off experimentally, but that was a "dead" launch (i.e., with no one on board). Except for that, the "Seagull V" is the first amphibian flying boat to be designed specifically with catapult launching in view, and

the machine may therefore be said to introduce a new phase in marine aviation. This is not the place to discuss the uses and advantages of an amphibian flying boat capable of being launched by catapult, but without going into details, it will be obvious that an aircraft which can take off from an aerodrome, the deck of a carrier, or from a catapult placed on a carrier or on a cruiser, and which can alight on land or on a carrier, as well as on the sea, has a field of action far in excess of the aircraft which is either pure landplane or pure seaplane. That a certain price has to be paid for these advantages in the form of a slightly smaller disposable load, and probably a very small reduction in performance, goes without saying. In the Supermarine "Seagull V," however, the retractable undercarriage has been so designed that, when raised, it adds but very little extra drag, the wheels being housed in the wing.

The "Seagull V" is the very up-to-date descendant of machines in use by the R.A.F., the R.A.A.F., the Spanish and Japanese air forces ten years ago or more. The original "Seagull," it may be remembered, differed from most of the single-engined boats of those days in being a tractor. It is interesting to observe that in the latest type, although this is fitted with a radial air-cooled engine, the "pusher" arrangement has been adopted once more, thus reversing the placing as compared with the early "Seagull," but reverting to what was almost standard practice



THE "SEAGULL V": This side view gives a good idea of the general lines of the machine. The view from the pilot's cabin is particularly good.

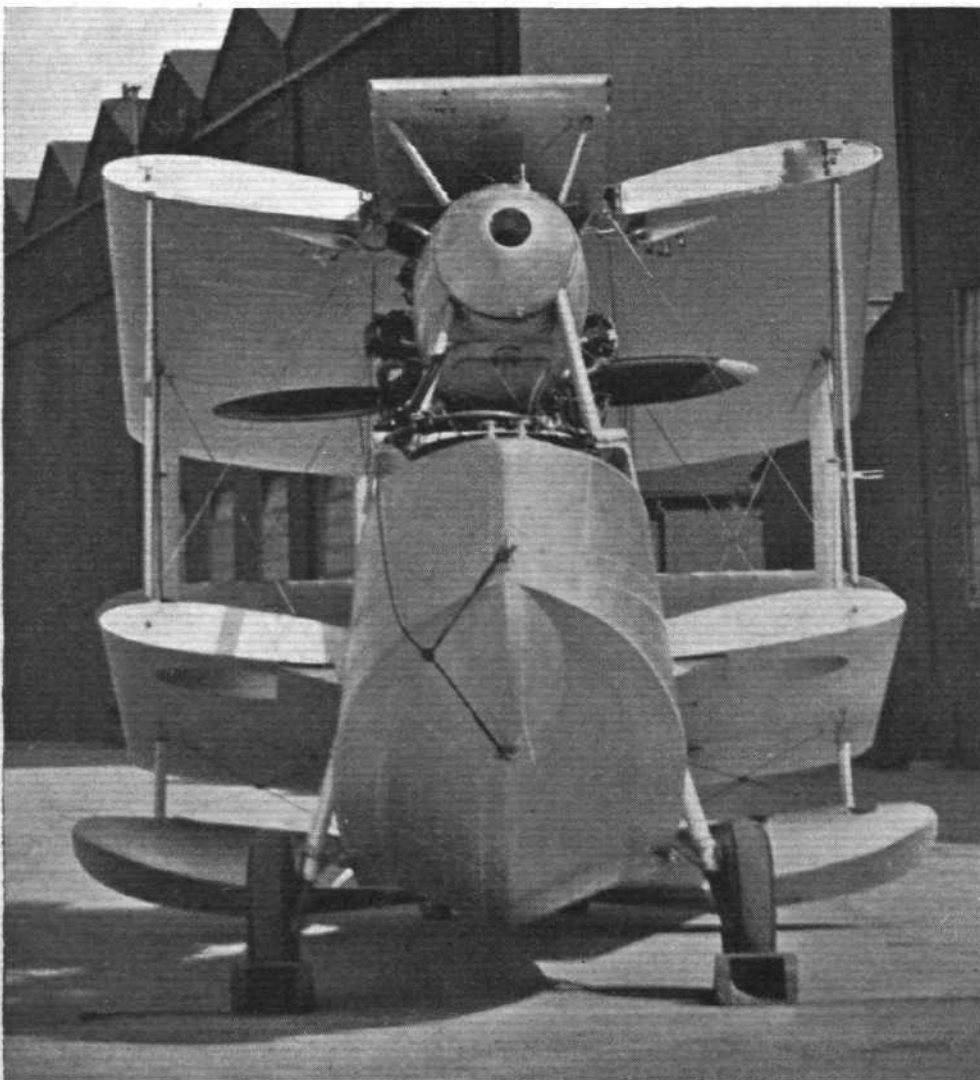


**GOING—GOING—GONE :** The "Seagull V" catapulted at Farnborough. The first picture shows the machine being drawn up the slope to the catapult. Then comes a picture showing the claws which secure the machine. In the next all is in readiness for launching by the catapult, and finally the "Seagull V" is seen just as it leaves the catapult, piloted by Flt. Lt. S. R. Ubee. (FLIGHT Photos.)

in the early days of flying boats. In a single-engined boat there are several advantages in adopting the "pusher" arrangement, notably in that the airscrew is kept well up out of the way of spray, and secondly that in picking up moorings and manoeuvring on the sea generally, the crew can use the forward deck without risk of being struck by

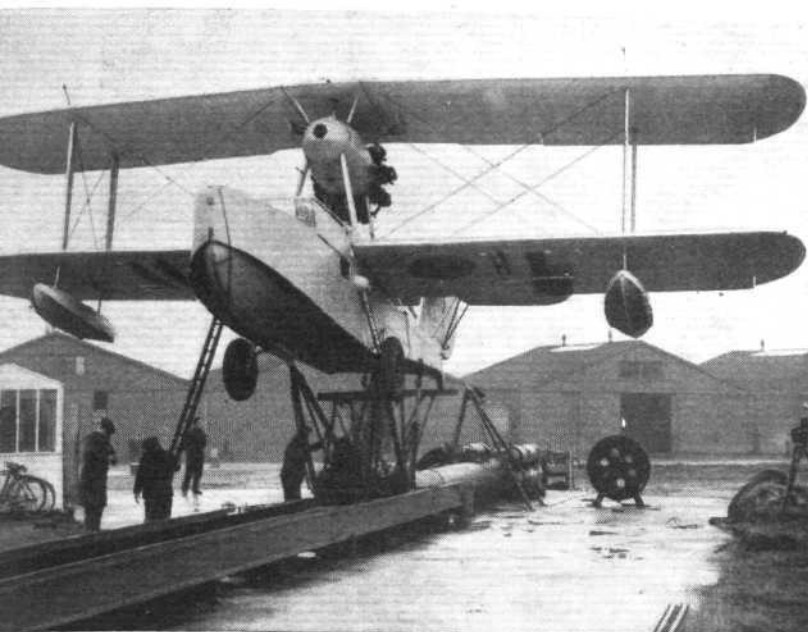
the propeller blades as might occur in a tractor machine.

Some weeks ago we had the privilege of witnessing catapult trials of the "Seagull V" at the Royal Aircraft Establishment, Farnborough. The large new catapult of ship's type (*i.e.*, not the transportable type demonstrated at R.A.F. Displays) was used for the tests. The photographs at the top of this page show the stages in the launching. The machine was wheeled up the slope until the four claws of the catapult could be engaged with the fittings at the step and on the chine of the aft portion of the hull. When the four attachments had been secured, the telescopic ram of the catapult was retracted, carrying the machine with it. The Bristol "Pegasus" engine was started, and Flt. Lt. Sydney R. Ubee, of the Experimental Section, R.A.E., took his place in the machine, wedging his head firmly against the padding at the back of his head; he raised his hands in signal, the catapult crew "fired," and in the space of a few seconds the machine was in the air. In spite of the very short time in which the machine was accelerated from rest to flying speed, there was a marked absence of shock or jerk, and the impression was one of extreme smoothness. Careful watching failed to reveal any tendency of the machine to tip up or down, but whether that was due to the skill of the pilot or to the fact that two accelerating forces were at work—the catapult near the bottom of the machine and the airscrew thrust an equal distance above the centre of gravity—is difficult to say. One would expect that at the instant when the machine leaves the catapult, and the lower accelerating force is



**FOR STOWAGE :** The "Seagull V" with wings folded. Note the small folded width.





removed while the upper is increasing, there would be a tendency for the machine to dip. If such a tendency was present, it was not noticeable. Only the slow-motion film of the launch which was taken by the Vickers photographic department could reveal such details. To the eye they were imperceptible, due to the speed with which everything happened.

The great point is that the launch proved definitely that a flying boat can be launched by catapult.

#### Structural Features

In general design the Supermarine "Seagull," Mark V, is an orthodox biplane superstructure carried on an all-metal hull, with the engine mounted on struts from the top of the hull, and the top centre-section braced by four short struts from the engine mounting. The biplane wings have a single pair of struts on each side, and bracing is by streamline wires in the normal way.

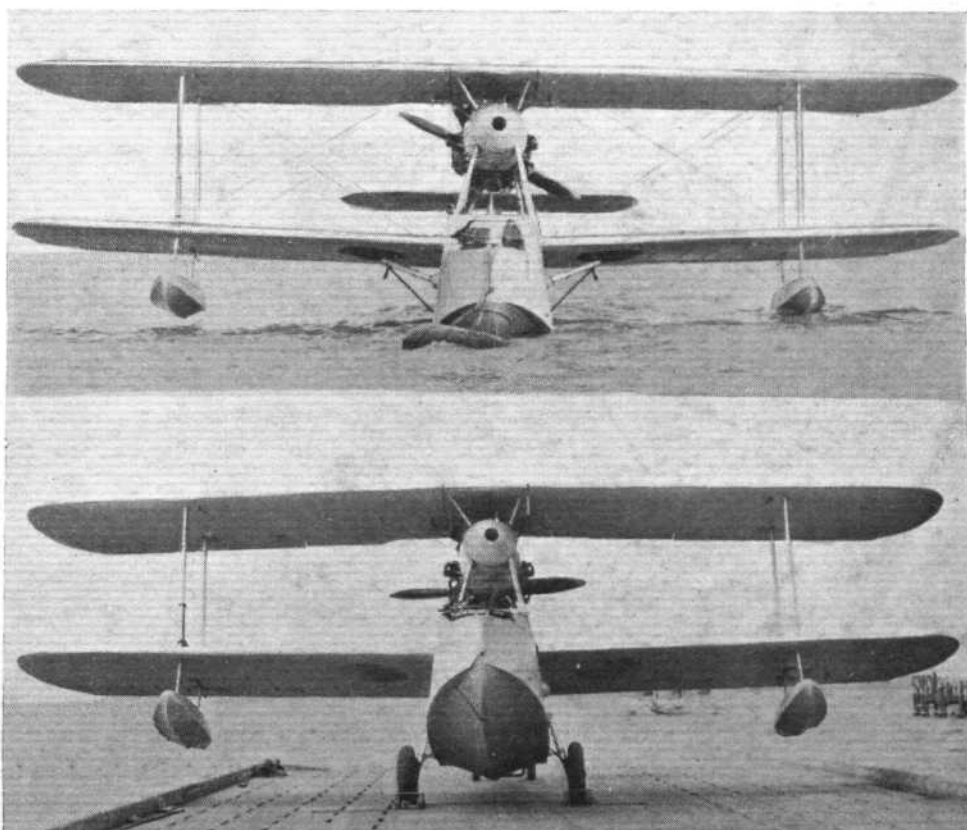
The hull of the "Seagull" is of the type which is coming more and more into use in this country: flat sides and straight-vee bottom, with a flat towards the chine where formerly reverse curves used to be found on all British flying boats. It is interesting to reflect that the flat-sided straight-vee type of hull was the earliest of all, and that curves and reverse curves were introduced later as refinements in hulls named after the late Mr. Linton Hope. Lately there has been a tendency to revert to the straight-line frames, which make construction somewhat easier and avoids the need for "panel beating," now that metal plating has been universally adopted.

Aluminium alloys are used in the construction of the hull, and the wings are of composite construction, with built-up spars of stainless steel, and wooden ribs and secondary structure. The wing covering is fabric.

Although this is not intended to be a technical description of the "Seagull V," a few words about the retractable undercarriage may not be out of place. Reference has already been made to the fact that this is of very neat design. Briefly, the system consists in hinging the telescopic leg to the

side of the hull. A radius rod runs from the lower end of the telescopic leg to a point a few inches above the chine. The upper end of the telescopic leg projects diagonally into the interior of the hull, where it is attached to the rod of a hydraulic plunger. When this plunger is operated by the pilot, the end of the leg is pulled down, the outer end rises, and when the limiting position has been reached, the wheel is buried in a circular recess in the wing, leaving exposed only the telescopic leg and the radius rod. In the "down" position, the telescopic leg is locked to the chine by a plunger.

The Bristol "Pegasus" engine is, as already mentioned, mounted as a "pusher." It is carried on a monocoque nacelle, inside which is the oil tank, which at the same time acts as an oil cooler. If the machine is to be used in very hot climates, extra cooling can be obtained by fitting externally on the nacelle a Vickers-Potts oil cooler. A large manhole in the bottom of the nacelle gives access to the engine accessories, while smaller inspection holes are provided in various places to facilitate adjustments of such accessories as cannot readily be reached through the main manhole. The petrol is carried in two tanks in the



**CLEAN FRONTS:** These two views of the "Seagull V" on the sea and on land show the care taken to reduce drag.

**THE AMPHIBIAN GEAR :** Note that when in the raised position the wheel is completely housed in a recess in the wing.

upper wing, one on each side of the centre-section, and feed is by gravity to the engine. A four-bladed wooden "pusher" airscrew is fitted.

#### Accommodation

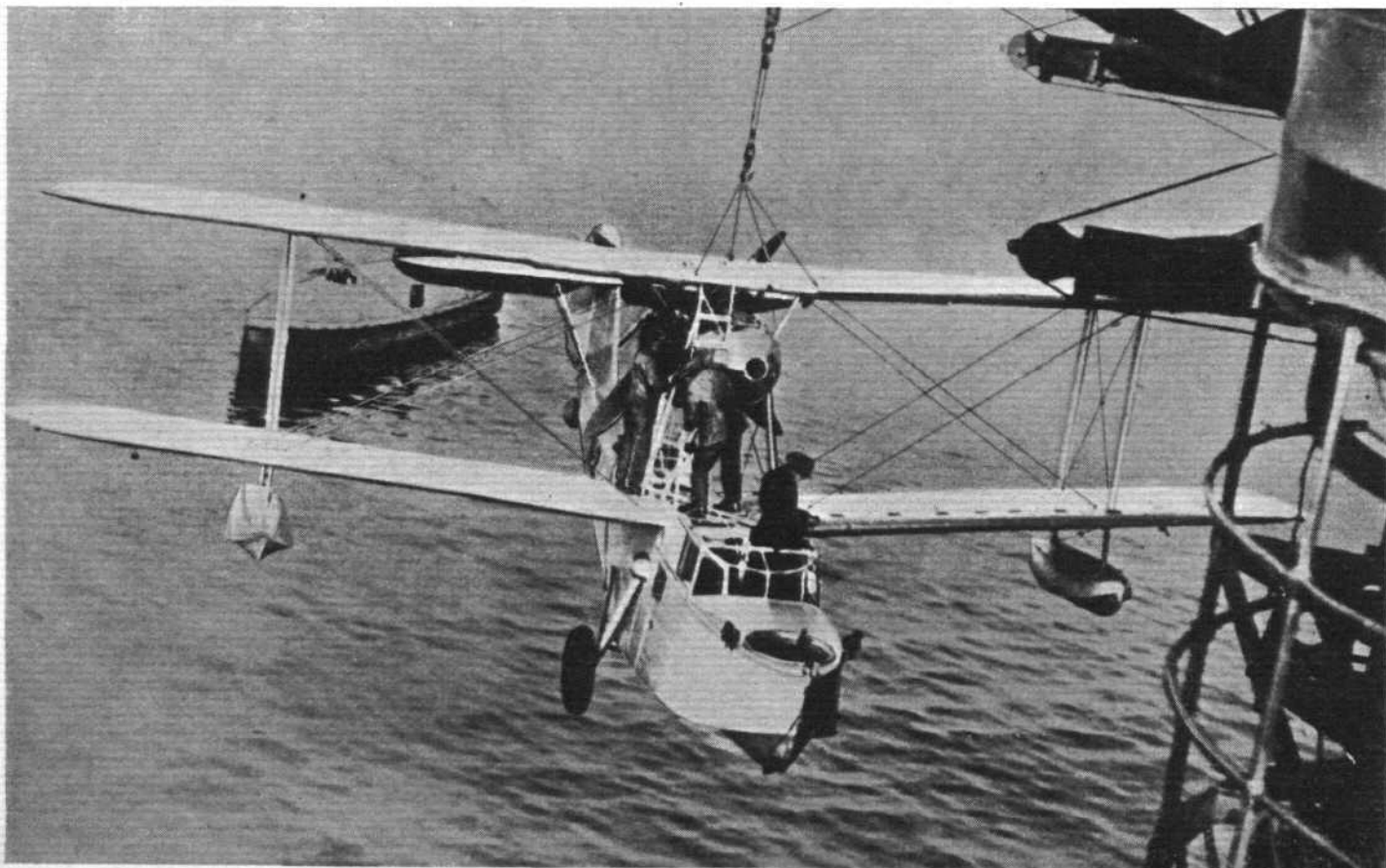
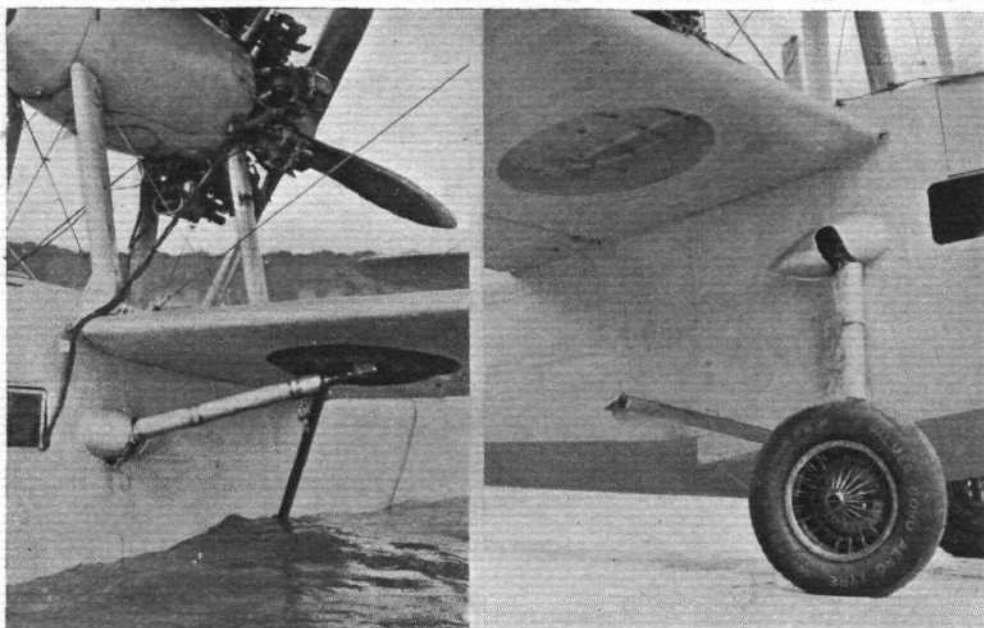
The lay-out of the interior of the hull is of orthodox arrangement, but the dimensions are such that there is plenty of room everywhere. In the extreme bows is an open cockpit fitted with Scarff gun ring. A detachable cover is provided for this cockpit, in the compartment under which is stowed the mooring equipment. Then follows the pilot's compartment, with sliding windows in sides and roof. Provision is made for a second set of controls to be fitted in front of the starboard side, so that the machine can be used for instructional work if desired.

Between the pilot's cockpit and the front spar frame is the navigator's compartment, with large table for chart box, windows for taking bearings and observations. Aft of that is the wireless operator's position, and finally behind the wings is the rear gunner's cockpit. Owing to the fact that the engine is a "pusher," the cabin is comparatively quiet; at any rate, sufficiently so to make conversation possible without telephones. This should be a valuable feature, especially if the machine is being used for training work.

In connection with the slow-motion film mentioned on a previous page, we have, since above article was written, had an opportunity to see at Vickers House, Broadway, Westminster, not only this but also a film of the catapult

launching taken at normal speed. The feature to which we referred, *i.e.*, a slight dip at the instant the aircraft leaves the catapult, could just be seen in the normal film, and the pilot could be seen correcting it with a flick of the elevator. The slow-motion picture was taken from a different viewpoint, and did not appear to show any dip, although a slight flick of the elevator was noticed. It seems certain that the tendency to dip is by no means violent.

The behaviour of the "Seagull V" on the water was also shown, in another film, and the slow-motion film of the take-off and alighting characteristics was extremely interesting. The machine appears to run very cleanly, and the undercarriage strut to the chine does not seem to cause any spray. As soon as any speed is attained the water seems to be flung out beyond the strut.



**IN THE MEDITERRANEAN :** The Supermarine "Seagull V" being hoisted on board the aircraft carrier *Courageous*. A photograph showing the machine, with a number of others, on the flying deck of the carrier was published in our issue of March 15.



# From the Clubs

## HATFIELD

**The London Aeroplane Club.**—No flying was carried out on Monday and Tuesday of last week on account of rain and mist. Amongst new members we have pleasure in welcoming Mr. J. A. Lubbock. Mr. Oehlers made a very creditable first solo. The flying time for the week was 41 hr. 40 min. The continual rain and wind which was experienced at the beginning of last week stopped most flying, although a few of our private owners, including Sir Derwent Hall-Caine and Messrs. Matusch, Miskin and Goldsmith, braved the elements on Sunday last. However, the weather cleared in time to allow the seven "Tiger Moths" and the "Dragon" to leave for Denmark, and they took off in very good formation on Thursday last in brilliant sunshine, under the control of Capt. C. G. Larsen. Work is soon to be started on constructing two hard tennis courts and a pavilion. It is hoped to increase this later on to six courts. So Club members will now have the opportunity of playing squash and tennis, and also enjoy the pleasures of riding and swimming when they visit the aerodrome. The Club played its last squash match of the season on March 21 last at the R.A.F. Station, Henlow, and won by four games to one. On the previous Saturday, the Club played against Guy's Hospital at home, and lost by three games to two, after a very close match. Arrangements are now being made for a fixture list for next season.

**R.A.F. Reserve Flying Club.**—This club has now changed its name to the Royal Air Force Flying Club, as the membership has been opened, not only to all pilots of the Reserve of Air Force Officers, but also to past and present officers of all the flying services in the country as well as past and present members of the Oxford and Cambridge University Air Squadrons. The club's annual flying display will be held on June 16 at Hatfield and will be on similar lines to the opening display held last July, it being understood that considerable R.A.F. support will be granted. Club members flew 5 hr. 45 min. during the week ending March 17, and 5 hr. 30 min. last week.

## HANWORTH

Flying time on club aircraft for the week ending March 23 amounted to 30 hours 25 minutes. On Thursday Mr. I. Ramsay carried out his first flying test for his "B" licence, flying to Croydon, Lympne and Hamble. Mr. Kirwan passed his navigation test for his "B" licence on Friday. The Saro "Cloud" belonging to British Flying Boats, Ltd., recently left the London Air Park, for Cowes, Isle of Wight, after having had its engines completely overhauled in the Hanworth workshops.

## BROOKLANDS

Weather last week has been unsettled and visibility poor, curtailing school flying considerably, the total hours for the week being 42, 18 dual and 24 solo. Cross-country flights were carried out to Lympne, Penshurst, Abington and three to Aintree. New members joining last week were

Messrs. D. McMartin and Sir Philip Richardson brought his usual large party for joyrides; he is determined to make the general public air-minded and sets an excellent example himself. Local excitement was caused by the arrival by air of the films for the Weybridge Picture House flown by Max Findlay in one of the club machines, the crowd waiting to welcome getting rather wet with the blustering wind and rain. Quite a few machines have changed hands through the Sales Department, including a new "Dragon," "Puss Moth," "Cirrus Moth" and a "Gipsy Bluebird." Undoubtedly the price of second-hand aircraft will soon be rising, as there is definitely a scarcity of good second-hand machines. The first Dawn Patrol is to be arranged on April 1. Members will be allowed to get in the air before any unusual 1st of April happenings take place. During the Easter Race Meeting visiting pilots are reminded that they should arrive before the races commence and that no landing fee is charged.

## NATIONAL FLYING SERVICES, LTD.

The period of management of the Receiver, Mr. C. J. G. Palmour, has been extended until June 8, 1934.

## CINQUE PORTS FLYING CLUB

Flying times suffered last week owing to an overdose of fog, but Mr. Brown has been able to complete his "A" licence tests, and Mr. R. Dupe made a successful first solo. The latter is the youngest son of our well-known second aerodrome officer at Lympne. Mr. Parker, after only 5½ hours' dual, is now ready for solo. The Bristol Fighter which belonged to Mr. Tony Wilson and came second in the Folkestone Aero Trophy, 1933, averaging 113½ m.p.h., has now changed hands, and is the property of Mr. J. P. W. Topham. Mr. Ken Waller and Mr. Bernard Rubin made a good start on Thursday last, reaching Cannes on the first night, Brindisi the second night, and Athens at 15.00 hours the third day out. They reported bad weather conditions as far as Brindisi, but perfect weather at Athens. Now that Mr. K. K. Brown is on his own he has had to give early morning instruction in order to keep up with his pupils. If the weather improves, he will need an assistant to help him until Mr. Waller returns from Australia.

## YORKSHIRE AEROPLANE CLUB

Approximately 8 hours have been flown from Yeadon during March 9 to March 22, including two single-journey flights to London and one return flight to and from London. Capt. P. Lambert, of Hull, has joined the Yorkshire Aeroplane Club.

## READING AERO CLUB

Glorious spring weather and great aerial activity sum up last week-end at Woodley Aerodrome. The Club Formation, this time Messrs. Ogilvie, Bishop and Higgs, visited Brooklands in the morning, and in the afternoon Messrs. Harrison and Higgs went over to Hanworth in the former's "Hawk," which, as usual, aroused great interest.



FROM INDIA : One of the hangars and some of the fleet of the Jodhpur Flying Club.

"Leopard Moth" A.C.L.L. visited the aerodrome in the morning, as did "Moth" A.B.A.G. In the afternoon Messrs. Bradbrooke and Barrett arrived in Mr. Bradbrooke's "Hawk"; Mr. Mannering came over from Brooklands in his "Moth" ("Gipsy I"), with another member, accompanied by one of the Brooklands Club "Moths," with two more of their members. "Moth" A.A.R.E. also arrived, and "Puss Moth" A.B.T.V., Sqd. Ldr. Rae of the Norfolk and Norwich Club, paid us a visit and tried out the demonstration "Hawk." There were five first solos during Saturday and Sunday, these being Messrs. Ritchie, Holland and Harper, two of these being apprentices at the Phillips & Powis works, and also Mr. Dash and Mr. Lewis Grundy. Mr. Grundy deserves special mention, as he had only been able to take instruction at very rare intervals over the last six months, and he has actually gone solo in a little over five hours. New pupils at the Phillips & Powis School are Mr. Singh Chowdhary, who is also training in the works for his Ground Engineer's "ticket," and Mr. F. R. Booth, home from Karachi, who, holding an Indian "A" licence, came for a "refresher." New members of the Reading Aero Club are Mr. A. H. Gordon and the aforementioned Mr. Booth. Flying time for the last two weeks, 49 hours, the first week being greatly interfered with by high winds.

## NORFOLK AND NORWICH AERO CLUB

With the fine weather last week there was a still greater increase of flying. Two cross-country flights were carried out, the first by Messrs. A. Kirkby and R. T. W. Ketton-Cremer, who flew to Hendon, where Mr. Ketton-Cremer passed his tests for his "A" licence. The other flight was made by Mr. A. J. Morris, who went to Cambridge for the day. The Club congratulates Mr. A. Kirkby, the Ground Engineer, on obtaining his Instructor's licence from the Guild of Air Pilots at Brough. Mrs. F. Crossley flew to Norwich during the week to take some advanced instruction from Mr. J. Collier. Others who received instruction during the week were Messrs. R. T. W. Ketton-Cremer, F. W. Rushmer and P. Britton. Soloists were:—Messrs. A. Kirkby, R. T. W. Ketton-Cremer, A. J. S. Morris, Mrs. F. Crossley, Messrs. A. R. Cox, S. Hansel, H. C. Stringer, and Miss W. Hudd. At the Annual Exhibition of the Norfolk and District Photographic Society, Mr. H. F. Low, the Club Photographer, was successful in winning the new challenge cup presented by Mr. H. N. Holmes for scientific prints. The photographs submitted by Mr. Low for this exhibition were selected by him from his work for the Club. A very interesting lantern lecture was given at the Club on March 23 to a large number of people. The subject of the lecture was "Norfolk Archaeology from the Air," and was run under the joint auspices of the Norfolk and Norwich Archaeology Society and the Club. Professor D. Atkinson, who gave the lecture, based his explanations on a number of slides made from air photographs, taken by the Club last summer, of archaeological sites in the county. For purposes of comparison, the Professor brought with him a number of slides taken in Wiltshire. Prior to Professor Atkinson's lecture, Capt. A. A. Rice, the Chairman of the Club, gave a short demonstration of the methods of air photography, and showed a number of very good examples of Mr. Low's work in this field. Through indisposition, the President of the Norfolk and Norwich Archaeological Society, Mr. H. Teasdel, was absent from the lecture, and the Deputy Lord Mayor (Mr. T. Glover) presided in his place.

The Club will be open on Good Friday and Easter Monday, but flying will cease on the following Tuesday and Wednesday. The Club will be open as usual during the week-end. The Club has been given a contract by the Air Ministry for a number of co-operation flights with the 409th Battery A.A., Lowestoft, during training. This entails a series of 20 flights, during which the Club machine will fly over the district of Lowestoft at varying heights for a period of 1 to 1½ hours. The first of these flights will take place on Good Friday, Easter Sunday and Monday. Another supper dance will be held at the Club House at 8.30 p.m. on Friday, April 6. Wally Drane's "Follies" Band will be again engaged until 1 a.m. It is hoped that all members will do their best to attend this function, and any friends they bring with them will be most welcome. Tickets are 3s. 6d. each, and are obtainable in advance from the Club Secretary. It greatly helps the organisation of these dances if members would kindly take their tickets in advance.

## MARSHALL'S FLYING SCHOOL

Flying for the week ending March 25:—Dual, 16 hr. 30 min.; solo, 9 hr. 10 min. One new member is Mr. R. R. Ransom. Mr. H. R. Dimock completed his tests for "A" licence, and Mr. R. B. Finney made a first solo flight. Visiting machines were an "Avian" and a Miles "Hawk," demonstrated by Mr. Miles. Mrs. Crossley made a cross-country flight to Norwich; other cross-country flights were to Heston and Coventry.

## LIVERPOOL AND DISTRICT AERO CLUB

High winds and rain considerably curtailed flying during the week ending March 23. The total flying time for the week was 32 hr. 50 min., including 11 hr. 50 min. dual and 21 hr. 0 min. solo.

## MIDLAND AERO CLUB

Total flying times of Club aircraft for the week ending March 18 were 6 hr. 10 min. dual and 4 hr. 40 min. solo. Cross-country flights were carried out to Hooton and Desford. High wind and rain precluded flying on four days during the week. A very successful Dance was held at the Grand Hotel, Birmingham, on March 15, over 250 people being present. Two new machines have been added to the "Private Owners' Fleet"—Mr. C. W. R. Gleeson having acquired D.H. "Moth" ("Gipsy II") G-ABU, and Mr. H. L. Johnson, "Puss Moth" (Gipsy Major) G-ABYU. The Club will close from March 30 to April 2—but petrol and oil will be available.

## THE BENGAL FLYING CLUB

Dawn fogs have hampered the early risers somewhat during February, but, enthusiasm undamped, this small sturdy band have turned up with unfailing regularity—full of hope.

The Annual Inauguration Gymkhana of the Club was held on February 11, H.E. the Governor of Bengal honoured the Club with his presence. A large crowd gathered to watch the competitions, demonstrations of flying and aerobatics, and joy-rides were very popular. A slight mishap marred the early part of the day when one of the recently-trained pilots, after competing in the Balloon-Bursting Competition, damaged his undercarriage when landing—putting the machine out of action for the day. Mr. M. P. Thomas came to the rescue, lending the Club his private aeroplane for the whole day.

The following are the prize winners of the competitions in connection with the Gymkhana:—

General Flying Competition (A) and (B) and Balloon-Bursting Competition	Sir Rajendra Chatterjee Trophy	Mr. Aroon Mukherjee
General Flying Competition (A)—Flying Test	The Bagram Challenge Cup	Mr. R. Pal Choudhuri.
General Flying Competition (B)—Landing	The Warner Challenge Cup	Mr. H. I. Matthews.
Balloon-Bursting Competition	Cup presented by the Club	Mr. Aroon Mukherjee.
General Flying Competition (A) and (B)—Novices	The Governor Challenge Cup	Mr. J. G. Woollard.
Bomb-Dropping Competition (Members)	Cup presented by the Club	Mr. A. Roy.
Do. (Non-Members)	Do.	Mr. Dhandhanja.
Obstacle Race	Do.	Dr. H. Rahim.
Height Judging Competition	Do.	Miss M. Surita, Mr. C. P. Bhatt, Mr. D. C. Ghose.

There have been two cross-country flights this month as under:—Mr. R. D. M. Pattison and Mr. Knowles (22/2/34), Asansol and return. Mr. B. L. Dhawan (26/2/34), Narail and return. *Taxi Flying*.—Mr. K. D. Knocker and Mr. W. C. Tomlin, Patna to Asansol. Mr. K. D. Knocker and Mr. W. C. Tomlin, Asansol to Dum Dum.

The following new members commenced their instruction:—Dr. S. K. Ganguly, Mr. R. H. Duncan, Mr. S. F. Ellahi. *First Solo*.—Mr. D. M. Mehta. Mrs. I. J. Lewis passed the necessary tests for "A" licence. The Club hopes to start some serious Night Flying in the near future. A start was made on the 28th, when two joy-rides were given—Miss Macgilchrist opening the proceedings. Mr. Matthews then had 15 min. dual. The Flying Return for the month was:—Dual, 56 hr. 50 min.; Solo, 51 hr. 10 min.; Night Flying, 40 min.

## THE AERO CLUB OF CEYLON

The Aero Club of Ceylon reports that, with reference to the Government's investigation in connection with the establishment of an aerodrome in Ceylon, sites are being inspected, values ascertained, and recommendations drawn up, all of which information will be forwarded to the Ministry concerned for submission to the State Council, if approved. The membership of the Aero Club has jumped from 95 to 112 in a few months.



# Air Transport & Commerce

## THE STINSON "MODEL A" TRANSPORT

THERE are, in the U.S.A., several large towns which, although they lie on the main trunk air routes, are inadequately served by air. The reason for this is that the high speed aircraft working the long range services are not justified in stopping at these towns owing to the consequent reduction in speed over their route and the extra cost involved. On reviewing this situation the Stinson Aircraft Corporation decided to build a fast three-engined high performance passenger aircraft to sell at less than the large types and to operate at less cost per passenger mile.

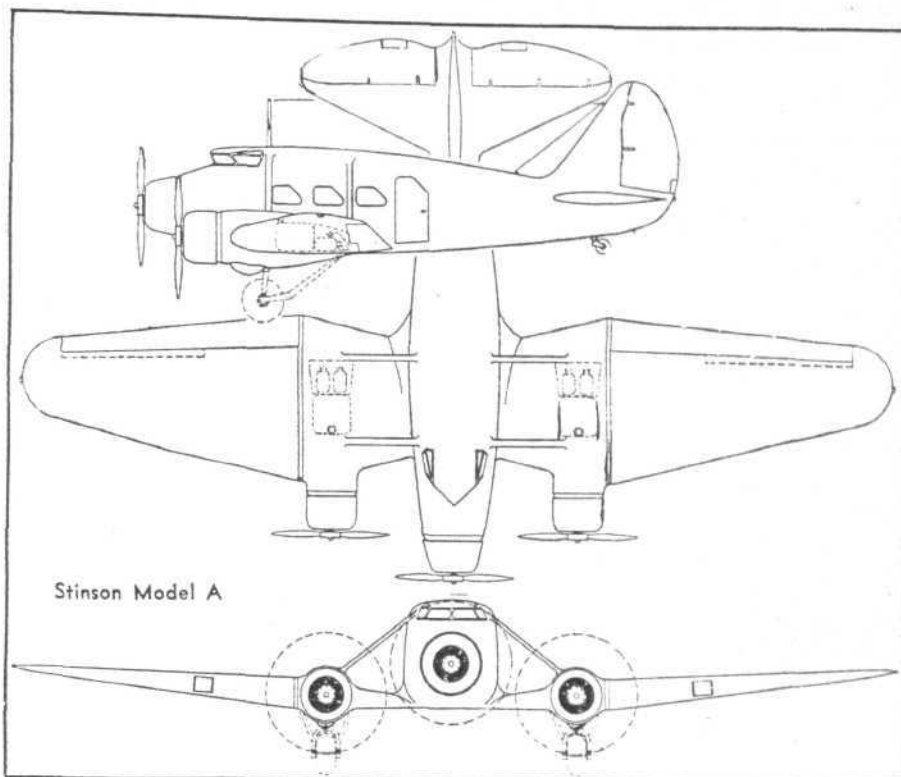
Design was begun in 1932 and the aircraft will be put into production early this spring. A new type of wing is used, but the fuselage follows standard practice, as it is of chrome-molybdenum tubing.

As may be seen from the G.A. drawings, for which we are indebted to our contemporary *Aero Digest*, the wings, in plan form, resemble somewhat those of our "Monospar" S.T.4. The centre sections taper both in plan form and thickness towards the fuselage. The two outboard engines are mounted in a fashion recommended by the N.A.C.A. for maximum efficiency, but we are inclined to think that the nose engine must be comparatively inefficient owing to the large size of fuselage. It must be remembered, however, that the "Stinson Model A" is not the only triple-engined low-wing passenger aircraft being built in the U.S. to-day, for we call to mind the G.A.38, a drawing of which was published in *FLIGHT* for February 1, 1934. M. Wibault has demonstrated in his type 282 T12 that a triple-engined machine with comparatively large fuselage which is by no means of ideal streamline shape can be made extraordinarily efficient by the suppression of extraneous excrescences.

In the new Stinson, close attention has been given to seating arrangements, vision, quietness, ventilation and heating. Eight hammock-type chairs are provided in the cabin, and four of these may face a common centre for luncheon or card games. A large baggage compartment in the rear of the cabin is loaded from the outside but is easily accessible from the inside. A lavatory is also located to the rear of the cabin. Additional mail is carried in the nacelles.

A cockpit for two pilots (if two pilots are needed on short feeder line services) is located forward of the cabin where, it may be gathered from the drawings, vision is excellent. A large mirror for rear vision for use while taxiing is mounted over the cockpit.

The engines are three Lycoming nine-cylinder radials rated at 240 h.p. at 2,000 r.p.m., driving Smith controllable-pitch aircrews. These aircrews are operated in unison by a device which is practically automatic after



Stinson Model A

### THE STINSON "MODEL A" TRANSPORT

#### Three 240-h.p. Lycoming

Wing span	..	60 ft. (18.29 m).
Length	..	36 ft. 10 in. (11.21 m).
Height (including radio mast)	..	14 ft. 2 in. (4.57 m).
Total power	..	720 h.p.
Power available for cruising	..	540 h.p.
Gross weight	..	8,750 lb.
Pay load	..	1,860 lb. (3 968.67 kg).
Wing loading	..	17.5 lb./sq. ft. (85.3 kg/m <sup>2</sup> ).
Power loading	..	12.2 lb./h.p. (5.53 kg/h.p.).
Wing area	..	500 sq. ft. (46.45 m <sup>2</sup> ).
Ailerons	..	53.5 sq. ft. (4.97 m <sup>2</sup> ).
Flaps (at 60 deg.)	..	41.6 sq. ft. (3.87 m <sup>2</sup> ).
Horizontal tail surfaces	..	105 sq. ft. (9.75 m <sup>2</sup> ).
Vertical tail surfaces	..	35 sq. ft. (3.25 m <sup>2</sup> ).
Cruising speed at 5,000 ft.	..	150 m.p.h. (241.4 km/hr.).
Cruising speed at 1,000 ft.	..	146 m.p.h. (234.96 km/hr.).
Climb at sea level (wheels up)	..	1,060 ft./min. (323 m/min.).
Climb at sea level (wheels down)	..	935 ft./min. (294 m/min.).
Range with 35 per cent. excess fuel	..	370 miles (595.5 km).

take-off, if the pilot so desires. This simplifies synchronisation of engine revolutions. Sperry Horizon and Sperry Gyro are fitted as standard and such refinements as Goodrich "de-icer" equipment and heated pitot head are optional.

suspended during the winter season, has now been resumed. Another company, The Société Aerea Méditerranée, has temporarily suspended its service between Rome, Florence and Venice.

#### THREE-CLASS AIR TRAVEL

In the flying boats to be used on the Marseilles-Algiers route of Air-France which will be started late in the spring, first-, second- and third-class compartments will be provided for the passengers.

#### SWISSAIR'S NEW G.A.43

THE G.A.43 high-speed passenger monoplane which has been purchased by the Swissair Co. was flown, on March 16, from Cherbourg to Zurich, with a halt at Le Bourget. The pilot was Zimmermann, who should not be confused with Mr. Balz Zimmermann, who is manager of Swissair.

#### BRINDISI-RHODES ROUTE REOPENS

THE weekly operation of the Brindisi-Athens-Rhodes service of the Sta. Aero Espresso Italiana which has been

## WIRELESS ON THE SEVILLE-CANARY ISLANDS SERVICE

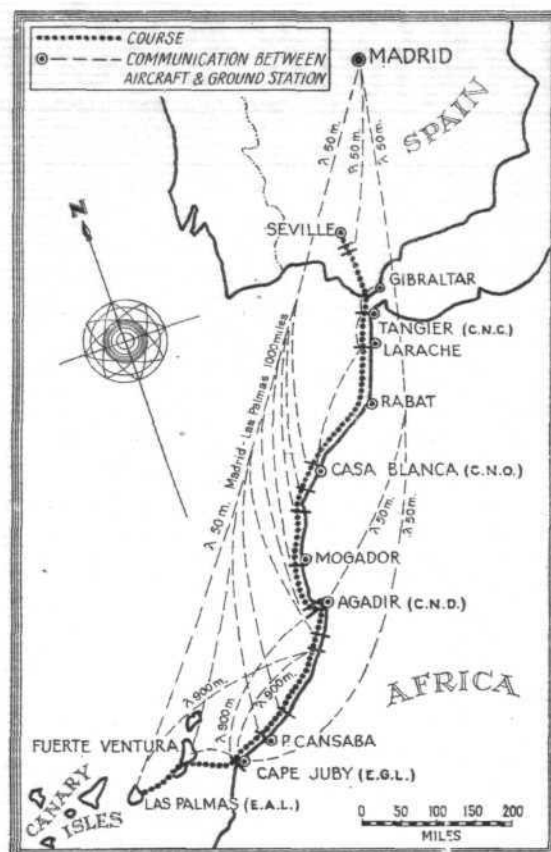
THE opening of the new Spanish airline from Seville to Canary Islands has again demonstrated the value for long-distance air routes of the Marconi combined medium- and short-wave aircraft equipment, Type A.D.37A/38A, as used in the Imperial Airways "Atalanta" class aeroplanes on the African and Indian routes. On the Spanish airline the aircraft follow the West African coast for about 1,100 kilometres flying distance, from Tangier to Cabo Juby (via Rabat, Casa Blanca, Mogador, Agadir and Cansaba), and across to Las Palmas via Fuerte Ventura. Throughout the flight they are in touch with the aerodromes at Madrid and Las Palmas by short-wave wireless (50 metres) and with the local coastal and aerodrome stations on the route by medium wave wireless (900 metres). In addition to normal air and ground communication, the wireless operators have also been able to report direct to Madrid by short-wave wireless after their machines have actually alighted at Agadir, Cabo Juby and Las Palmas. Lineas Aeraes Postales Espanolas, the operating company, have sent congratulations to the Marconi Company, through its Spanish associates, in the following letter signed by Señor Cesar Gomez Lucia, Managing Director of L.A.P.E.:—"During the recent voyage I have just made on board the first aeroplane of our company which has been resuming the service from Seville to the Canaries, I had the satisfaction of observing the high efficiency of the material of your company installed on board. I did not for a single moment fail to maintain communication with our short-wave station at Madrid with the rest of the company's aeroplanes which were flying, and with the stations of the Peninsula, Africa and the Archipelago. I think it would be very difficult to surpass these successful communications, since it is not necessary to have greater efficiency than that of being able to communicate with all points concerned, and with this letter I send you my heartiest congratulations. Trusting that the problem of communications with aeroplanes has now been settled once and for all in the same way as it was on the first voyage."

### RAILWAY-AIR SERVICES, LIMITED

THE new company formed by the four principal railway companies, the L.M.S. Railway, the Great Western Railway, the Southern Railway and the L.N.E. Railway, in conjunction with Imperial Airways, Ltd., has been registered under the title of Railway-Air Services, Ltd. The chairman is to be Brig. Gen. Sir Harold Hartley, M.C., Vice-President of the L.M.S. Railway. The nominal capital is £50,000 in £1 shares. The five constituent companies will each appoint one director. Mr. O. H. Corble, Assistant General Manager of the L.N.E. Railway, will represent that company. It is understood that a statement of plans will be issued in a few days. Sir Harold Hartley is 56, and was educated at Dulwich College. He has been a Fellow and Tutor of Balliol College, Oxford. During the war he won the Military Cross, was mentioned three times in dispatches, and was promoted to Brig. General. He organised the supply of gas for the British Army after the first gas attack by the Germans at Ypres in April, 1915. In 1918 he was made Controller of the Chemical Warfare Department of the Ministry of Munitions.

### THE GREAT AWAKENING?

GREAT BRITAIN, Canada, and Newfoundland have combined their efforts to secure for the Empire the quickest mail service to the Far East, to reduce the time from London to Montreal from 6½ days to four days and to accelerate the distribution of mails throughout Canada



THE SEVILLE - CANARY ISLANDS SERVICE: Map showing the route and wireless stations.

and U.S.A. Steamships of the Canadian Pacific Line will use ship to shore and shore to ship aircraft as they did during the Ottawa Conference two years ago. Ships off the west coast of Ireland will be overtaken by aeroplanes carrying mails. On arrival at Belle Isle at the mouth of the St. Lawrence River, they will leave the vessel with the mails. Another factor of extreme importance in the new scheme is the provision of a 2,500-mile trans-Canadian air line from Montreal to Vancouver. The mails will be transferred, at Vancouver, to steamships, for transport to China and Japan. During the summer months, the mails being carried on the Atlantic service will travel by way of Belle Isle, where they will be collected by aircraft and flown 500 miles to Shediac, New Brunswick. When the St. Lawrence is ice bound, aircraft will leave the ship at Cape Race and fly 550 miles to Shediac. Until the trans-Canadian route is completed, the mails will be flown to Rimouski for transport by railway.

### RAILWAYS TAKE OVER UNION AIRWAYS (S. AFRICA)

FROM February 1 the control of Union Airways passed into the hands of the Department of Railways and Harbours. The precise terms of the agreement, states *Shell Aviation News*, by which the Government takes over the

Union Airways' undertaking have not yet been disclosed, but it is gathered that there will be no payment by the State for goodwill, and that the shareholders will receive no payment. The Government will, however, pay out overseas creditors, so it is understood, on the basis of 10s. in the £. The new State Airways Service will in future be run as an adjunct to the Union Railways and Harbours Department under the direction of Lt. Col. J. Holthouse (Director of Civil Aviation), who will be responsible to the General Manager of the Railways. A significant point in the agreement is the report that the Government will carry out the terms of certain contracts into which Union Airways have entered for new aeroplanes, several of which, it is understood, are on order, and which will be taken over by the railways on arrival in South Africa. There is every reason to believe that these new machines will be of the Junkers Ju.52 type. Direction-finding wireless stations are to be erected throughout the country, and all pilots employed on the new service will be required to qualify in blind flying at Roberts Heights. It is expected that the services at present operated by Union Airways, a daily Durban-Rand service in both directions, and a weekly Durban-Cape Town service, will be slightly curtailed at the start to enable pilots to be trained in blind flying, and the additional wireless facilities to be installed. The existing Union Airways' pilots and machines are likely to continue to operate the Durban-Rand mail service until the whole position has been reviewed by Col. Holthouse. Union Airways have used Shell fuel exclusively in all their aircraft, while both AeroShell and Shell aircraft oils have been supplied to the company in considerable quantities.

### INDIAN NATIONAL AIRWAYS

IF the scheme, under the consideration of Indian National Airways, to extend the bi-weekly air service from Sylhat and Chittagong materialises, Assam will be linked with Bengal by an air service. It is reported that seaplanes are to be acquired by Indian National Airways for use on the Burma line to connect with these towns, as landplanes would not be suitable for this service. Incidentally, Indian National Airways are contemplating the establishment of a flying school in Rangoon. Statistics for the past two months show the development and popularity of the inland service. The Calcutta-Dacca and Rangoon services were inaugurated only last December, but 16,500 miles and 62,356 passenger miles have been



flown and 262 lb. of mail and half a ton of freight have been carried. About 3,000 miles were flown on short pleasure flights. During the same period 83 passengers were carried on the Dacca line and 53 passengers on the Rangoon line. About 7,000 miles and 33,000 passenger miles were flown during January on the Rangoon service and 98 lb. mail were carried. In the same month nearly 10,000 miles were flown on the Dacca service, 42 passengers and 99 lb. of mail were carried and over a ton of newspapers. Joyrides and short pleasure flights were given to 1,000 people and 4,000 miles were flown on charter work over the earthquake area.

#### UNITED AIR LINES IN 1933

We have received from United Air Lines, of Chicago, the following statistics regarding their air services during 1933. Figures for the previous year are given for comparison:—

	1932.	1933.
Passengers ... ..	88,933	127,693
Miles flown ... ..	13,055,804	14,714,415
Mail (lb.) ... ..	3,336,368	3,182,165
Express ... ..	172,326	479,512

Of the 1,250,000 miles of flying scheduled monthly, 95 per cent. was completed. Air mail represented 45 per cent. of the company's revenue during the first six months of the present fiscal year. It is probable that much of the increased business is attributable to the company's investment in a large number of Boeing 247 monoplanes (two "Wasps") which speeded up existing services by 40 m.p.h. These Boeings have flown about 13,000,000 miles since last summer. Ten more have been ordered. Experiments are proceeding with some 247's fitted with geared "Wasps" and three-blade controllable-pitch metal air-screws, and this change may enable United Air Lines to speed up their services still more. A big reduction in cabin noise is also obtained with the new installations.

#### PORTSMOUTH, SOUTHSEA AND I.O.W. SERVICES

FROM March 29 to April 3 there will be a half-hourly service in operation between Portsmouth, Ryde and Shanklin. The fares will be reduced between Portsmouth and Ryde to 4s. 6d. single and 8s. 6d. return, and between Portsmouth and Shanklin to 8s. single and 14s. return. For the first time cheap day returns will be available at certain times, to Ryde 5s. 6d. return and to Shanklin 11s. return. Between Easter and Whitsun the services between Portsmouth, Ryde and Shanklin will operate hourly, and from Whitsun until September 15, half-hourly again. The bi-daily service between Portsmouth, the Isle of Wight and Brighton will continue to operate until May 16, when it will be extended to Bournemouth with connections to Plymouth, Bristol and Cardiff. This will enable passengers from the Isle of Wight to travel by air to Plymouth, Bournemouth, Bristol and Cardiff, and vice versa. Full details of this latter service have not

yet been determined. The aircraft used will be a three-engined Westland Wessex seating 9 passengers, supported by D.H. Fox Moths.

#### MISR-AIRWORK SERVICES

DURING the week ending March 5, 131 passengers were carried on the Alexandria twice-daily service from Cairo. The Upper Egypt twice-weekly service carried 38 passengers, and 12 passengers were carried on the new twice-weekly service to Palestine—in all, 181 passengers. Among British passengers on the Misr-Airwork airlines were Lord Clydesdale, Lord Hamilton and Lady Margaret Drummond Hay. It is interesting to hear that on March 4, when weather conditions in Egypt and Palestine were so bad that ships were unable to dock, and one of the worst sandstorms experienced for some considerable time was raging in both countries, holding up shipping and railway services, all the Misr-Airwork regular airlines ran to schedule. Among those who chartered aeroplanes from Misr-Airwork during the same week were H.E. the High Commissioner for Egypt, Baron Empain, H.E. Talaat Harb Pasha, Sir Cecil Clementi, the Hon. John Butler, Lady Margaret Drummond-Hay, and Miss Moira Katherine Hunter.

#### BIRKETT'S MANCHESTER BRANCH

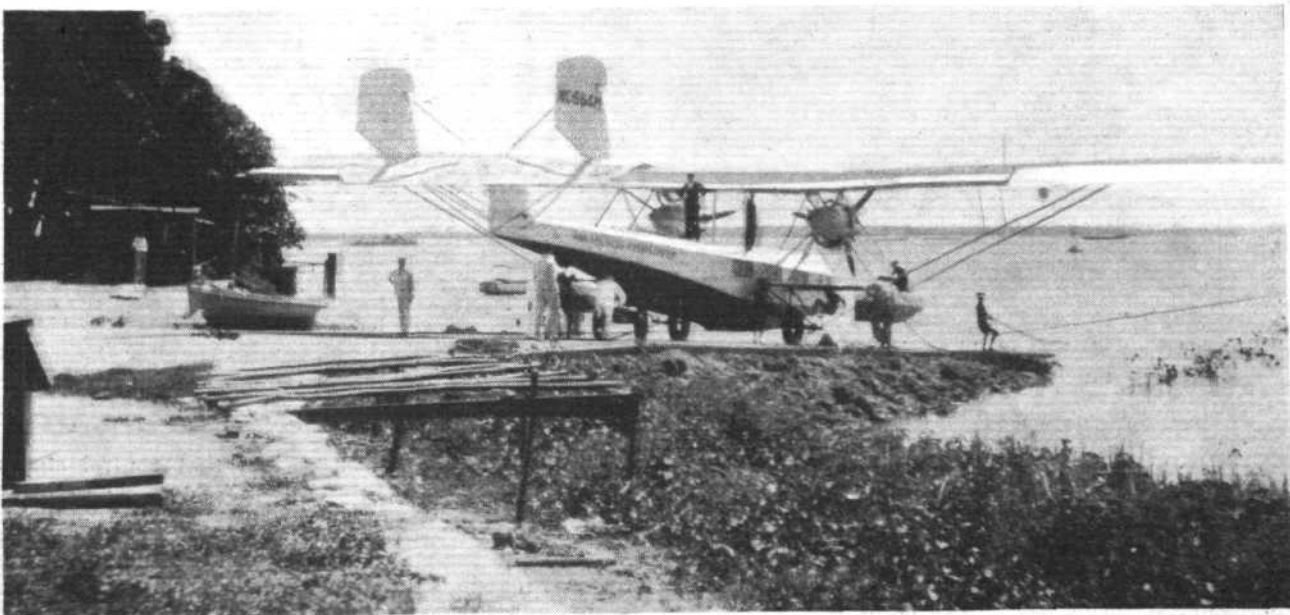
BIRKETT AIR SERVICE have extended their activities to Manchester (Woodford), and the first aeroplane for this branch, a "Puss Moth," was delivered this week. It was flown up North by Mr. William Thorn, late of Brooklands, who shortly after made the first taxi flight from the new branch—a charter to the Lincoln.

#### WRIGHTSON & PEARSE RUN TO LE TOUQUET

WRIGHTSON & PEARSE will, commencing to-day, Thursday, March 29, run three times daily to Le Touquet and back, using "Dragons." The fares are £3 single and £5 return, including motor transport to and from the aerodromes. London passengers will be met at the May Fair Hotel. Machines will leave Heston at 10 a.m., 1 p.m. and 4 p.m., arriving at Berck an hour later. The return services will leave Berck at 11.30 a.m., 2.30 p.m. and 5.30 p.m. An extra early-morning service, leaving Berck at 8.30 a.m. on the Tuesday after Easter, will enable London business men to make the very most of the Easter holiday. Similar services will be operated during Whitsun week, and for two months commencing on July 1.

#### FOKKER F.XX IN REGULAR SERVICE

Zilvermeeuw, the Fokker F.XX (three Wright "Cyclones") belonging to K.L.M., has been operating, since March 1, on the Amsterdam Berlin service. She has covered the 364 miles, under suitable conditions, in 1 hr. 57 min. to Berlin and in 2 hr. 15 min. to Amsterdam. According to figures received from the Fokker Company during October, 1933, the top speed of the Fokker XX was 186 m.p.h., but later reports put the figure at 202 m.p.h., with a cruising speed of 171 m.p.h.



FROM PERU: A Panair (Pan-American Airways) Consolidated "Commodore" arrives at Para from New York. This photo was taken by Miss Winifred Brown during her visit to S. America and Upper Amazon—on which subject she is now giving a series of lectures.

## PLESSEY AIRCRAFT RADIO EQUIPMENT

**A**LREADY there are a large number of the smaller—small that is in comparison with Imperial Airways—operators who have found the use of radio a very great advantage. Not only is this the case for those taxi operators who, particularly when on newspaper and Press work, have to fly through almost every kind of weather and can only do so by keeping in radio touch with Croydon, but also there is no doubt that it will be impossible to run the majority of the proposed internal air lines, about which everyone is talking so much now, without the widespread use of radio. It will be necessary to have a regular and efficient meteorological service for the dissemination of weather reports and also a number of direction finding stations which can give pilots of those aircraft accurate information as to their position, at any moment during the flight.

A firm which has recently evolved a compact light, but none the less efficient radio equipment for aircraft in this category, is the Plessey Co., of Ilford. We recently had the opportunity of trying out their AC44 equipment as fitted in a "Moth," and found it not only simple, but as far as we could discover foolproof to work. We had been told that safety devices made it impossible to overload the valves, and these were tested by earthing the aerial and then switching on the transmitter. No harm whatsoever resulted.

This equipment is made in two forms. The A.C.44, which is of medium power and is intended for use on civil or military aircraft where telegraph or telephone communication is required on medium waves and where remote operation and wave length changing is required between any one of four preset wave lengths; and the A.C.44B., which is similar in its essentials, but provides for a continuously variable wave length range and is not intended for installations which necessitate the use of remote control. The A.C.44 can be preset to operate on four wave lengths between 600 and 1 000 metres, and those generally used for aircraft purposes are 600, 862, 900 and 930 metres. If desired, however, other wave bands can be provided.

The receiver tuning is continuously variable over the same wave band and, if required, can be provided with a second band above or below the normal or on short waves.



The Plessey AC.44 aircraft radio equipment. The control unit is on the left.

The transmitter, which is of the type employing a master oscillator for frequency control, is coupled to the aerial circuit in a special manner which prevents overloading of the amplifiers should the aerial be lost. Telegraphy and I.C.W. are obtained by means of a low power modulation system. The output of the transmitter is:—

C.W. telegraphy .. .. .	36 watts
Telephone .. .. .	18 ..
I.C.W. telegraphy .. .. .	18 ..

Under normal conditions a range of 150 miles is obtained with telegraphy and I.C.W. and 250 miles with C.W.

The construction is somewhat unique in that external shock absorbing devices are not required, as the apparatus is carried on a magnesium framework which, through sorbo rubber rings, is connected to a tubular steel crate with enclosed ventilated sides. The receiver is of the super-heterodyne type with automatic volume control, and special circuits for the reception of C.W. telegraphic signals. Four valves are employed with an output power sufficient for loud reception in two pairs of headphones.

The control unit of the Plessey equipment is an unusual but efficient item, which solves all the problems connected with remote control. It contains small meters showing the total current consumption and the aerial current, jacks for microphone telephones and key, a volume control, and a receiver tuning control, thus obviating the necessity for operating a tuning control on the main instrument by mechanical means with its attendant drawbacks. The use of a tuning control separated from the receiver by many feet of cable is a great achievement, as it would normally, one would suppose, lead to instability. This drawback has, however, been completely overcome in this Plessey equipment. This method of separating the control unit from the main instrument confines the use of Bowden wire controls to the operation of definite-movement items like the off-receive-send switch, C.W.-telephone-I.C.W. switches for transmitter and receiver and the wave length change. Either a trailing aerial or a fixed aerial may be used and any normal form of power supply such as a double voltage wind or engine-driven generator (the model we inspected was supplied by a double voltage generator made by the Electrode-Dynamic Co.), or a rotary transformer running from a battery, according to which suits the aircraft best. The following table gives the dimensions and weight of the equipment:—

	Dimensions	Weight
Transmitter .. .. .	14 × 7 × 11 in.	15 lb.
Receiver .. .. .	14 × 7 × 3½ in.	3 lb. 11 oz.
Control unit .. .. .	8½ × 6½ × 2½ in.	3 lb. 2 oz.
Remote controls .. .. .	—	6 lb.
Winch with aerial wire and weight	6 in. diam.	7 lb.
Fairlead .. .. .	According to installation	2 lb. 8 oz.
Microphone .. .. .	—	10 oz.
Telephones (one pair)	—	10 oz.
Telegraph key .. .. .	—	12 oz.
Generator and wind-mill	12 × 4½ in.	14 lb.
Cables .. .. .	According to installation	—
Crate .. .. .	9 × 16½ × 17 in.	5 lb.
Approximate total weight, type A.C. 44 ..		60 lb.
.. .. . A.C. 44B ..		54 lb.

From this it will be seen that the whole outfit is very compact and, indeed, still allows ample room for the passenger when installed in the front cockpit of a "Moth."

### Television developments

**B**EFORE a number of Air Ministry officials, a demonstration of Baird Television was given on Monday, March 26. The latest apparatus is a great improvement on that previously used. The definition has been made far finer than hitherto by increasing the screen division to 180, horizontally. This has largely eradicated flicker, and the picture, as presented on the fluorescent screen, can be compared in quality to the best newspaper photograph reproduction. The cathode ray tube has also been improved and enlarged, so that the screen for normal home use is now about 10 by 12 inches in size. It was

suggested, at the demonstration, that control stations at aerodromes could in future televise a map to aircraft pilots whereon would be marked their position as obtained from directional wireless fixes. The position of other aircraft in the vicinity would also be marked, and it was thereby considered that flight through fog would be made safer. Probably, however, the weight of the apparatus will be considered too much for the present, and it does not seem likely that much use will be made of the system in aircraft until a means is discovered of showing the pilot a picture of the ground and obstructions ahead of, and immediately in the vicinity of, his machine.



The  
**AIRCRAFT**  
**ENGINEER**  
"FLIGHT"  
ENGINEERING SECTION

Edited by C. M. POULSEN

No. 98 (Volume IX) 9th Year  
No. 3

March 29, 1934

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SOME DEVELOPMENTS IN AIRCRAFT CONSTRUCTION

THE paper under above title written by Mr. H. J. Pollard, of the Bristol Aeroplane Co., Ltd., and of which he gave a spoken summary at a meeting of the R.Ae.S. on March 15, was of particular interest to aircraft engineers. In FLIGHT last week we published a summary of the paper, and some of the photographs which illustrated it. For the benefit of our more technically-minded readers we give below the appendices in which Mr. Pollard gives details of various formulæ, etc., from certain publications to which he referred, but which are not readily available to British aircraft engineers.

Before giving Mr. Pollard's appendices, there is a section of his paper which had to be dealt with somewhat sketchily in FLIGHT last week, but which should be mentioned here. That is the section on multi-spar wings. Concerning the problems of economic use of

materials in monoplane and biplane wings, Mr. Pollard said:—

"As to structure weights all that can be said at present is that when we have chosen the most favourable material and placed it most favourably for giving strength and stiffness, then we have done all that can be done to obtain the minimum possible weight. The principles I have outlined certainly show the way. An idea of what is to be gained as regards spar weights is shown in Fig. 11, the two aircraft concerned being very nearly the same weight and designed to the same load factors. The variations in sectional area along the length of a monoplane front spar are shown in curve *a*, while the stresses along the boom for one condition of flight are shown in curve *b*. Curve *c* shows the variation in stress along the length of the top front spar of a biplane wing, while curve *d* gives the average sectional area of the front top and bottom wing spars taken together as a single spar. The variation of sectional area of this virtual combination of spars cannot be shown conveniently in the diagram, but the variations in area of the top front spar in regions of high stress can be clearly distinguished at points *z*, *z*, etc., on the stress curve *b*. Due to the fixity at the point *p*, where the centre section and outer wing spars join, together

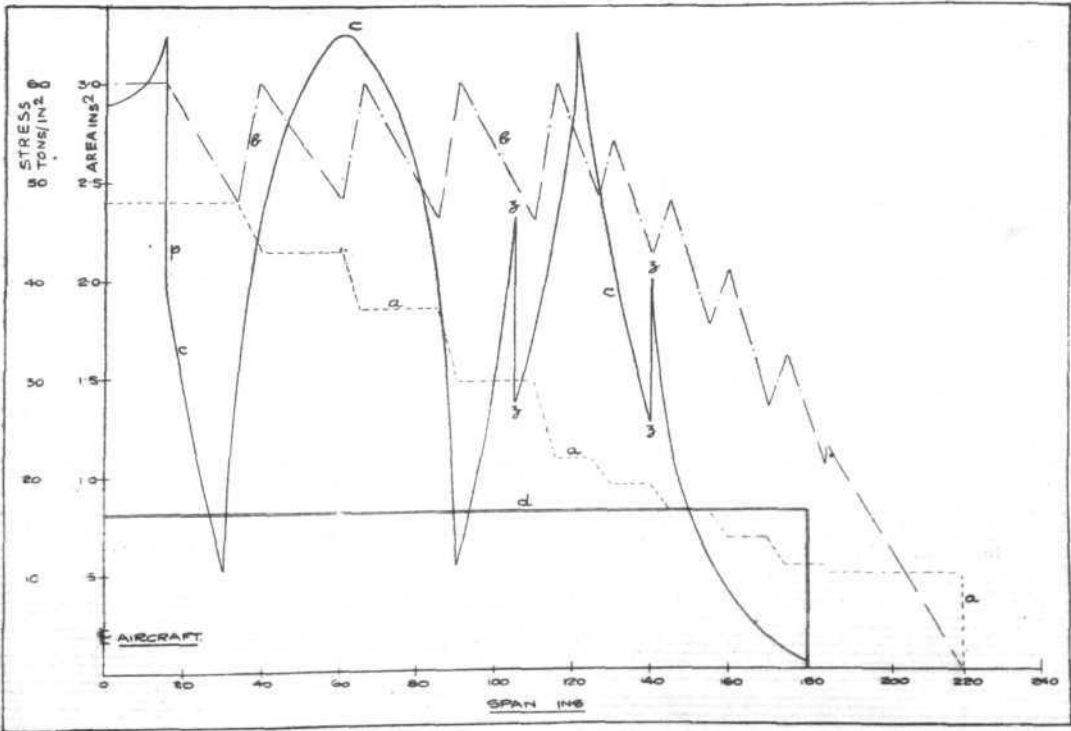


Fig 11. Sectional area and stress curves for monoplane and biplane spars, plotted against span. *a*, area of monoplane front spar. *b*, stress in monoplane front spar. *c*, stress in biplane top front spar. *d*, average area of all spar sections in front truss of biplane.

# SURVEYING WESTERN AUSTRALIA FOR GOLD



**THE GOLD SEEKERS:** The two D.H. "Dragons," *Golden West* and *Gay Prospector*, employed for surveying gold-mining areas in Western Australia.

**W**E have received some further particulars concerning the big aerial survey expedition now in progress in Western Australia, to which we have already referred on one or two previous occasions.

The expedition—the object of which is to locate new gold bearing formations—is the work of a new Australian company, the Western Mining Corporation, which, in addition to reopening certain existing mines, is making a consistent search for new mining fields. To assist the company's geologists, an air survey section, under the leadership of Wing Com. Laws, who was formerly in command of the Royal Air Force School of Photography in this country, has been equipped.

## Equipment of Aeroplanes

Two specially fitted two-engined de Havilland "Dragons," *Gay Prospector* and *Golden West*, are being used in the survey. Both planes are equipped with two tanks, each holding 36 gallons of motor spirit, and an extra tank holding 24 gallons, giving a total flying range of eight hours, or 800 to 900 miles. The undercarriages of the planes have been strengthened, and large sized wheels, protected with streamline "spats," have been fitted to allow the machines to operate from rough landing grounds.

Special mountings have been fitted to the floor of the cabin to carry cameras taking photographs vertically through a special port, while oblique photographs will be taken by special hand cameras through the aft windows of the cabin.

As very accurate flying is necessary for air photography, special compasses have been installed on the planes, and a Sperry Directional Gyro and a Reid Turn Indicator have been fitted to enable the pilots to steer a straight course. In the floor of the cockpit a drift sight is fitted. Another special instrument, a statoscope, will assist the pilot to maintain a constant height, as any variations would result in variations in the scale of the photograph.

## Directional Wireless

Photographing unmapped country presents many difficulties, and in order that the leader of the expedition and the pilots may know their position at any time, wireless apparatus is fitted to both planes. Three motor lorries, fitted with wireless telegraphy, telephony apparatus and direction finding instruments, will operate with the planes, so that with one lorry at headquarters and two in suitable positions in the area being photographed, the leader will be able to keep in close touch all the time with the

aeroplanes. A 10-in. camera lens is to be used, and from a height of 12,000 ft., at which most of the work will be done, each photograph will represent an area of 7,800 ft. by 10,572 ft. on the ground. The automatic Williamson Eagle Cameras will carry magazines containing 200 negatives.

Amongst the other special equipment to be carried will be a smoke bomb outfit by which the pilot can find the direction of the wind on the ground. It is also proposed to carry supply-dropping parachutes in case either of the aeroplanes has to make a forced landing in the bush.

## The Pilots

The two aeroplanes will be flown by Capt. C. W. Snook and Flt. Lt. Campbell. The latter is an Australian who was a pilot in Sir Douglas Mawson's expedition, and who since then has been engaged in British aircraft manufacturing works.

Wing Com. Laws is in charge of the whole aerial survey section, and the ground staff has been so chosen that there is an understudy for every job. For instance, two truck drivers are experienced pilots, and the clerical personnel are also able either to drive the trucks or act in other capacities.

## Plan of Operation

The method of operation of the air survey section is as follows. After an area has been selected, the aeroplanes, each carrying a geologist, will set off on their course, keeping in constant communication with their field wireless stations. Photographs will be taken of possible gold-bearing areas, and these will be used for examination by the company's geologists. The first base of the expedition has been established at Kalgoorlie.

## Benefit to Australia

The West Australian Government has granted certain rights to the company, as it feels that Western Australia particularly, and Australia generally, will benefit from the result of the attempt to discover new gold-bearing formations by means of modern methods. In all, reservations have been granted to the company covering areas totalling 12,000 square miles.

Efforts will be directed first of all to the examination of specially selected areas in the Kimberley, Kalgoorlie and Parker Range districts.

The Vacuum Oil Company is co-operating in the organisation of the survey and has arranged supplies of motor spirit and Mobiloil for both the aerial and the ground expeditions.



## "Air Day"

ON Wednesday, March 21, Sir Philip Sassoon, Under-Secretary of State for Air, stated that proposals were under consideration for the institution of an annual "Air Day," when facilities would be provided for the public to visit R.A.F. stations and Government civil aerodromes. Although quite non-committal, this statement is generally considered to be equivalent to an admission of the intention of the Government to support the scheme.

## Air defence demonstration at Royal Tournament

THE organising committee of this year's Royal Tournament has decided to stage an event portraying the defence of London by territorial anti-aircraft units. Searchlights and "Archies" will be manned by crews wearing gas masks. At present there are two such territorial units, both of which are below their established strength, which means that only about 50 lights can be manned.



# Airisms from the Four Winds

## Autogiro "on a handkerchief"

DURING his recent tour of France and Spain, Mr. de la Cierva gave the C.30 P a thorough try-out. During a month's travelling he flew for 65 hours and gave 29 demonstrations, which included no less than 250 take-offs. More than 140 passengers were carried, and as there were everywhere hundreds of people watching to see how well the machine could take off and land, there was no "nursing" at all. In spite of this both the machine and the Armstrong-Siddeley 7-cyl. "Genet Major" engine gave no trouble of any kind. In fact, Mr. de la Cierva informs us that he gave them far less attention than he would have devoted to a car in comparable circumstances. By far the most interesting test of the machine took place when Mr. de la Cierva alighted on, and afterwards took off from, the small platform of the *Dedalo*, a small seaplane transport, which has no flying deck in the ordinary sense of the word. The available platform measured only 177 ft. in length, by a width tapering from 52 ft. to 40 ft., extending from the stern to approximately amidship, where there is a bridge superstructure and a funnel. The *Dedalo* was at anchor in Valencia harbour, and the wind was not more than 10 m.p.h. From 2,000 ft. the platform, as one may imagine, looked diminutive, but when he came down low to have a look at it Mr. de la Cierva decided there was plenty of room and landed successfully, using less than one-half of the length, and landing right on the centre line, without using his wheel brakes to pull up. The take off was equally successful, and Mr. de la Cierva is convinced that quite a small platform will suffice if the machine is being flown by a good pilot. This seems definitely to bring the Autogiro into the running for ship-to-shore mail carrying, such as that which it is proposed to experiment with between Ireland and Canada.

## Autogiro news

SINCE the beginning of this year, the Cierva Autogiro Co., Ltd., has sold 26 C.30P. direct control type "Autogiros." Ten of these are being supplied to the Air Ministry for issue to Army Co-operation Squadrons. Señor J. de la Cierva has now returned from his Spanish tour on which, as previously recorded in FLIGHT, he demonstrated the C.30P. machine in several towns. The Swedish Government, we understand, has ordered six C.30P. machines, two for the Army, two for the Navy and two for the Police. A Swedish company, the director of which is Mr. Rolff von Bahr, who was recently in England, has been appointed by A. V. Roe & Co., Ltd., as agents for "Autogiros" in Sweden. Mr. von Bahr has flown a C.19 Mark IV out to Sweden and has placed an order for a C.30P. The number of private owners who have acquired "Autogiros" is rapidly increasing. The Hon. Ernest Guinness has ordered a C.30P. Another purchaser is Mr.

J. H. Moller, of Aberdeen. Mr. John Sword, a director of Midland & Scottish Air Ferries, Ltd., who is the agent in Scotland for "Autogiros," has also bought a C.30P. A. V. Roe & Co., Ltd., who have drawn up a programme for the production of thirty direct control machines, have now increased this number to forty.

## Air survey of the Amazon

DON RAMON PEREZ DE AYALA, the Spanish Ambassador in London, recently inspected at the de Havilland factory a "Fox Moth" ("Gipsy Major") seaplane which is to form part of the equipment of an expedition to the mysterious upper waters of the River Amazon. Under the leadership of Capt. Iglesias, who made five years ago, in company with Capt. Jimenez, a non-stop flight of 4,000 miles from Seville to Bahia, Brazil, the expedition will pursue the adventure to the point where three nations join—Brazil, Columbia and Peru—and beyond to the borders of Ecuador. The Spanish Ministry of Education is providing funds for the journey, which is being undertaken to examine the fauna and flora of the largest unknown area in the world, to make topographical surveys and to investigate the lives and customs of the head-hunting tribes who dwell there. A specially designed flat-bottomed 1,000-ton ship, suited for navigation of the great river for thousands of miles past Manaos, the farthest point to which orthodox craft penetrate, is being built in Spain. On its deck will be a shed to house the seaplane. The expedition will leave Spain early next year. Two Spanish aviators—Capt. Azcarraga and Pilot Reus—are in London to take delivery of the seaplane, which is fully equipped for aerial photography and survey.

## K.L.M. and the MacRobertson Races

ALTHOUGH the K.L.M. company has not yet officially entered any aircraft for the England-Australia Race, it seems fairly certain that if certain financial difficulties can be removed, two K.L.M. machines will be entered. According to present plans, these aircraft will be a Fokker F.XXXVI (four Wright "Cyclones") or a Fokker F.XXII (four Pratt & Whitney "Wasps") and a Douglas D.C.2 (two Wright "Cyclones"). The two Fokkers will be entered in the Handicap Race and the Douglas in the Speed Race. It is not the sole aim of K.L.M. to win prizes, but to demonstrate the high performance of modern standard passenger aircraft. For use on the Amsterdam-Batavia route, the F.XXXVI will carry 16 passengers, while the smaller Fokker will accommodate ten. This accommodation will be used to enable those interested in the races to fly over the course in a competing aircraft. On the completion of the race, ten days will be spent in Australia, and on the return trip a halt of a few days will be made in the Dutch East Indies. It is calculated that the return passenger fare for the trip will be 5,000 Dutch



**WESTLAND WESSEX FOR EGYPT:** A Westland Wessex, with accommodation for six passengers and pilot and navigator, has just been supplied by the Westland Aircraft Works to the Egyptian Army Air Force for transporting high officials in Egypt. The machine was submitted for acceptance tests at Heston and the guaranteed figures comfortably attained. On March 15 the machine set out for Egypt, the trip being made via Paris, Marseilles, Nice, Cagliari, Sardinia, Tunis, Tripoli, Cairo. Taking it in easy stages the machine arrived at Cairo on March 21. The pilot was Mr. D. P. Cameron, who has made this trip several times before.

guilders. Board and lodging along the route, first-class hotel accommodation in Australia and the Dutch Indies and the cost of various trips in both countries are included in this total. Already applications for seats have been received, but it depends largely on the amount of support received from the public whether the machines will be entered. It is possible that mail will be carried on the Douglas in the Speed Race, which should be good news to stamp collectors.

### "Postjager" for England-Australia Race?

It is rumoured in Holland that the Pander "Postjager" may be entered for the MacRobertson England-Australia Race. This aircraft, it may be remembered, made a very fast flight to Batavia some months back. It is fitted with three 420 h.p. Wright "Whirlwind" engines, has a maximum speed of 223.5 m.p.h., and cruises at about 186 m.p.h.

The American airwoman, Laura Ingals, has announced her intention of entering the race. She is at present in the Argentine.

### Rubens and Waller at Rome

MR. BERNARD RUBENS and Mr. Kenneth Waller, who are flying to Australia to survey a route for the MacRobertson Race, in which Mr. Rubens intends to enter a machine, arrived at Rome on Friday, March 23. Mr. Rubens will visit property which he owns near Melbourne, but will return in time to miss the Indian monsoons of late April. Mr. Waller is an instructor at the Cinque Ports Flying Club, of which Mr. Rubens is a member.

### Sir Malcolm Campbell's treasure hunt

SIR MALCOLM CAMPBELL, who is understood to be searching for treasure which was lost when an east Indiaman went ashore on the African coast some centuries ago, has moved his base from Luderitzbucht to Spencer Bay, about 80 miles to the north. Mr. Fulford, the chief pilot to the expedition, Dr. Bleek, a geologist, and one native are accompanying Sir Malcolm.

### An "Avian" in Antarctica

CONSUL LARS CHRISTENSEN, a Norwegian explorer and ship owner, has completed his third voyage in the Antarctic. In an interview with a representative of *The Times*, Consul Christensen gave some interesting examples of the employment of an Avro "Avian" with a "Cirrus" engine which was carried on board his ship. With two officers on board the "Avian" made a flight of about 45 min. from a point 65.22 S., and on landing the occupants reported that they had seen, beyond the Barrier Ice, land stretching for a distance of about 150 miles. Consul Christensen gave to this the name Princess Astrid Land, after the two year old daughter of the Crown Prince of Norway. On another flight, from a point 72.08 S., the officers reported that they could not see beyond the Barrier Ice, but Consul Christensen believes that new land lies beyond.

### More "Tiger Moths" for the R.A.F.

An order has been placed by the Air Ministry with the de Havilland Aircraft Co., Ltd., for a number of "Tiger Moth" training aircraft fitted with "Gipsy Major" engines. For several months past the "Tiger Moth" ("Gipsy III") has been used for training in the R.A.F. The new machines, which will probably be issued one to each Home Defence squadron, will have full blind-flying equipment. With "Gipsy Major" engine the "Tiger Moth" has a maximum speed of 109 m.p.h., a cruising speed of 93 m.p.h., and an absolute ceiling of 16,000 ft.

### Air sport in Soviet Russia

IN MOSCOW, recently, the first conference of flying clubs from all over the Union was held. The proceedings have shown the development of sporting flying in the Soviet Union. A year ago there were only 18 flying clubs in the country, but to-day there are 54 clubs attached to factories and "collective" farms. A club formed at the Frunze works in Moscow has a membership of 600. Over 14,000 persons were taught to glide last year, and this year it is hoped to train about 60,000. Children are encouraged to make flying models and every year "All Union" competitions are held.

### An Antwerp-Leopoldville trip

M. GUY HANSEZ, a well-known member of the Antwerp Aviation Club, will attempt, before the end of this month, a fast flight from Antwerp to Leopoldville. He will be accompanied by Mde. Hansez. The machine will be a D.H. "Dragon" (two "Gipsy Majors"). M. Hansez has been authorised to carry mail in both directions of his flight. It is improbable that the flight has any connection with a regular service to Leopoldville, for, it may be remembered, an agreement has been made between the

Sabena Company and the Belgian Government whereby Sabena will take over the operation of the route and will have the exclusive right for the transport of mails.

### Aircraft v. Locusts

A MESSAGE from Johannesburg states that military aircraft went into action on March 24 against locusts. An extensive campaign has been planned in all details by the S.A.A.F. The following is the method employed. A machine working in conjunction with parties on the ground flies in front of swarms of locusts which are just reaching the flying stage. This aircraft selects spraying places. Other aircraft fly over in formation and discharge clouds of sodium arsenate about 40 ft. above the ground. This settles on the locusts and kills them in flight, and as it gradually settles earthwards exterminates those still testing their wings. Up to the present the results of the tests have not been made known, but the South African Government is prepared to employ, if necessary, the whole of the Air Force to combat the locust menace.

### Another mystery of the Air solved

ON July 16, 1932, a Pan-American Grace air liner, the *San Jose*, left Santiago, Chile, for Argentina. The machine did not reach her destination, and despite an extensive search by aeroplanes and mountaineers, was never heard of again. A message from Mendoza, which was to have been the first stop of the machine on her journey, reports that the wreckage of the aircraft has been discovered half buried in snow, with the bodies of four passengers in the cabin. Four other bodies of passengers were beneath the wreckage, and it is believed that they attempted to jump from the machine before it struck the ground.

### Death of Dr. Hope

IT is with the very greatest regret that we have to record the death, at the age of 67, of Dr. J. L. A. Hope, M.R.C.S., of Addlestone, Surrey. Dr. Hope acted as honorary surgeon at a number of the light plane meetings at Lympne, where his charming ways and cheerful outlook endeared him to everyone who had the good fortune to become acquainted with him. To the last he followed closely the work of his son-in-law, Mr. W. S. Shackleton, and during the latter's stay in a nursing home, although suffering great pain himself, he made a point of visiting Mr. Shackleton several times. From an operation on Tuesday of last week Dr. Hope never recovered consciousness. To Mr. and Mrs. Shackleton, as well as to their two young sons, we offer our sincere sympathy.

### Col. Etherton's lecture tour

AT the Officers' Casino at Budapest on Monday, March 19, Col. P. T. Etherton, of the Houston Mount Everest Expedition, gave a lecture on the experiences of the expedition. Admiral Horthy, the Regent of Hungary, and Sir Patrick Ramsay were among those present. On the following Thursday Col. Etherton lectured in Rome. His audience included many prominent Italians, officers of the Regia Aeronautica, and Sir Eric Drummond, the British Ambassador in Rome. Col. Etherton is to be received by the Pope, who was himself a keen mountaineer, and who has shown great interest in the expedition.

### A real gold rush

MR. J. ROLAND ROBINSON, M.P., and Mr. E. G. H. Forsyth, directors of a company interested in gold, sailed on Wednesday in the *Olympic* for New York with their wives. The voyage is one stage of a dash by sea and air to British Guiana, where rich alluvial gold deposits are reported. From New York the party will travel in four aerial "hops" of a day each to Georgetown, the capital of British Guiana, by air.

### New Indian Air Force

THE addition of a clause to the Army and Air Force (Annual) Bill, which was introduced in the House of Commons this week, has been necessitated by the formation of the new Indian Air Force. The personnel of the new force will be Indian. Parliament will be asked to regulate the relations between members of the force and members of other military forces when units are on duty at the same station or are otherwise serving together. This point will be dealt with on lines similar to those which govern the relations between military, naval and air forces when acting together.

### Englishman killed in South American crash

WHILE taking off at Las Palmas aerodrome, Lima, the engines of a Pan-American Grace machine failed and the machine crashed. Three employees, including Mr. Frank Large, of Liverpool, were killed, and the Chilean Ambassador of Washington, Senor Manuel Trucco, was severely injured.



NEW AIRCRAFT

A DUTCH FIGHTER

THE Fokker D.XVII bears a strong family resemblance to the D.XVI. It may be remembered that this latter machine, fitted with the Armstrong-Siddeley "Panther" engine, was adopted by the Dutch Army Air Force. The D.XVII has larger wings than its forerunner and is fitted with a liquid-cooled engine in place of the air-cooled radial. Almost any modern "Vee" type engine may be fitted, Curtiss "Conqueror" and Rolls-Royce "Kestrel" engined versions having already been flown. Some D.XVII's which are at present being built will have the Hispano-Suiza 12 Xbrs or Lorraine "Petrel" engine. In the accompanying performance tables the power of the two French engines should be compared with that of the "Kestrel." The range of the machines with the various types of engine should also be noted.

The D.XVII's ordered by the Dutch Army Air Force are fitted with fully supercharged "Kestrels" and the first production machine with this engine has already been tested. In connection with the accompanying performance tables it should be noted that the weights and performances are guaranteed to within the following margins: 3 per cent. for weight empty, 3 per cent. in speeds and 6 per cent. in climb, providing the engine output and fuel consumption agree with the figures supplied by the engine builders. The wings of the D.XVII are of typical Fokker design, being tapered in thickness and chord and having rounded tips. The two box spars of the upper wing are of silver spruce, and the wing is secured by means of four bolts to a cabane mounted above the fuselage. The lower plane is in two halves, each consisting of two solid spars of laminated spruce. Each half is hinged to the lower longerons. The wings are covered partly with bakelite plywood and partly with fabric. This plywood covering runs from the top of the front wing spar over the leading edge back to the lower surface of the rear spar. The remainder is covered with fabric. The fuselage is a framework of seamless cold-drawn steel tubes welded together and braced by steel wires with turn buckles. The engine mounting, which is an integral part of the fuselage, is separated from the rest of

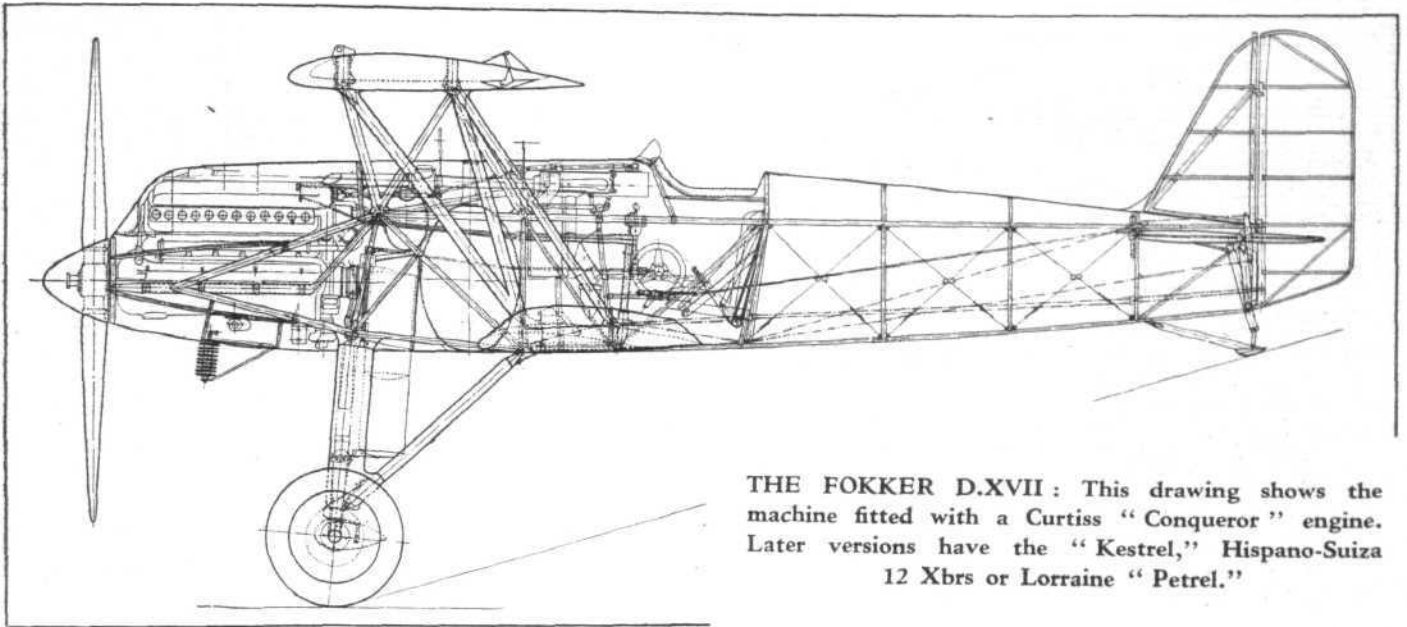
There must be many of our readers, who, although they are fully aware of the merits of the Fokker civil aircraft, are "in the dark" regarding the military types being produced by the firm. The following description of the Fokker D.XVII single-seater fighter, which, fitted with the Rolls Royce "Kestrel" IIS engine, has been adopted by the Dutch Army Air Force, should be of interest to many, especially those who have had dealings with such aircraft as the Fokker D.VII or the equally famous Triplane

THE FOKKER D. XVII			
Span .. .. .	31 ft. 6 in.		
Length .. .. .	23 ft. 7 in.		
Height .. .. .	9 ft. 10 in.		
Wing area .. .. .	215 sq. ft.		
Engine .. .. .	Rolls Royce Kestrel IIS	Hispano Suiza 12X brs.	Lorraine Petrel
Rated altitude .. .. .	13,200 ft.	14,800 ft.	11,500 ft.
Maximum output and r.p.m. .. .. .	585 h.p. 3,000 r.p.m.	670 h.p. 2,600 r.p.m.	815 h.p. 2,600 r.p.m.
Output at cruising speed .. .. .	390 h.p.	445 h.p.	545 h.p.
Weight empty .. .. .	2,512 lb.	2,490 lb.	2,645 lb.
Useful load .. .. .	838 lb.	838 lb.	838 lb.
Wing loading .. .. .	15.6 lb./sq. ft.	15.5 lb./sq. ft.	16.2 lb./sq. ft.
Power loading .. .. .	5.7 lb./h.p.	5 lb./h.p.	4.3 lb./h.p.
Maximum speed .. .. .	221 m.p.h.	231 m.p.h.	236 m.p.h.
Cruising speed .. .. .	186 m.p.h.	195 m.p.h.	199 m.p.h.
Climb to 3,300 ft. .. .. .	1.6 min.	1.4 min.	1.25 min.
Climb to 6,600 ft. .. .. .	3.2 min.	2.8 min.	2.5 min.
Climb to 9,900 ft. .. .. .	4.8 min.	4.2 min.	3.75 min.
Climb to 13,200 ft. .. .. .	6.4 min.	5.6 min.	5.1 min.
Climb to 16,400 ft. .. .. .	8.3 min.	7.1 min.	6.7 min.
Climb to 19,700 ft. .. .. .	10.7 min.	9.0 min.	8.7 min.
Climb to 23,000 ft. .. .. .	13.9 min.	11.5 min.	11.3 min.
Climb to 26,200 ft. .. .. .	18.7 min.	14.9 min.	14.9 min.
Absolute ceiling .. .. .	31,000 ft.	32,800 ft.	32,500 ft.
Service ceiling .. .. .	30,200 ft.	31,800 ft.	31,500 ft.
Range with full tanks .. .. .	410 miles	375 miles	310 miles

the structure by a fireproof bulkhead. Behind this bulkhead is the main fuel tank, to the rear of which is the pilot's cockpit. The pilot's seat may be adjusted vertically during flight and horizontally while on the ground. For the D.XVII machine being built for the Dutch Air Force a special instrument panel has been produced by Smith's Aircraft Instruments in which the instruments are indirectly lighted from behind the board. All the normal equipment carried in a single-seater fighter is conveniently stowed away. To the left of the pilot is a hand wheel for adjusting the tail plane and the throttle handle, to which are attached the triggers for the twin Vickers machine guns which are mounted in the top of the cowling immediately in front of the pilot. These guns may be either both of 0.303 calibre or one of 0.303 and one of 0.5 calibre. Both guns and their cartridge boxes are secured to a frame which is easily removable from the fuselage. The controls are of the conventional "stick" and rudder bar type. Ailerons are provided on the top wing



THE FOKKER D.XVII : This is the "Kestrel"-engined version supplied to the Dutch Army Air Force



**THE FOKKER D.XVII:** This drawing shows the machine fitted with a Curtiss "Conqueror" engine. Later versions have the "Kestrel," Hispano-Suiza 12 Xbrs or Lorraine "Petrel."

only. They are of wooden construction and are statically balanced.

The undercarriage consists of two Messier oleo pneumatic struts running from the wheels to the lower longerons. These struts are braced to the rear by means of two streamline tubes, also attached to the lower longerons. The wheels are fitted with independently-operated brakes and the tail skid is sprung with rubber in compression.

The fuel tank, which holds 57.2 Imp. gallons, is of welded sheet aluminium and is installed in the fuselage

near the centre of gravity. The tank may be provided with a bulletproof covering, in which case its capacity is reduced to 52.8 Imp. gallons. A motor pump feeds the engine, and a hand pump may be installed if desired. The oil tank, also of welded sheet aluminium, holds 4.4 Imp. gallons. A "honeycomb" water radiator of the fixed type is mounted beneath the fuselage between the legs of the undercarriage. Temperature is regulated by shutters operated by the pilot. A Vickers-Potts oil cooler is carried beneath the fuselage forward of the water radiator

## A Swedish Two-Seater Fighter: The Junkers K.47

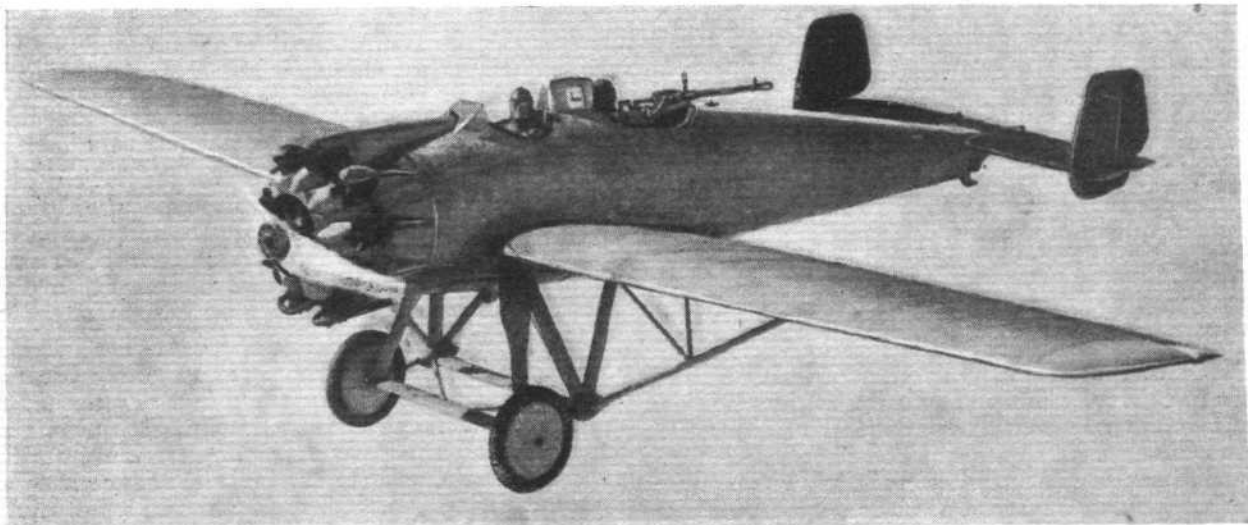
UNLIKE the majority of Junkers types produced during recent years, the type K.47 built in Sweden by the A.B. Flygindustri was designed primarily as a military type. The aircraft is a braced low-wing monoplane, with the wing consisting of a centre section, which is integral with the fuselage and two outer sections of trapezoidal shape. Spherical screw joints connect the wings to the centre section, and a single strut braces each outer wing to the undercarriage.

Structurally the wing is of typical Junkers multi-tube type, the torsional stresses being taken by corrugated sheet covering. A fuselage of oval section is used which consists of three parts, the engine section, the centre section containing the cockpits and the tail portion. The wing centre section and fuselage centre section are built up as one unit. Duralumin longerons are used, braced by transverse

members of the same material. Unlike the wings, the fuselage has a covering of smooth sheet duralumin.

Ailerons of high aspect ratio, statically and aerodynamically balanced, are used. The tail plane is adjustable in flight and is provided with a self-locking spindle adjustment controlled by a hand wheel in the pilot's cockpit. The elevators and tail plane are so large that the aircraft, when fully loaded and with the C.G. back, is still quite stable. Two fins with two balanced rudders are fixed to the extreme ends of the tail plane. This arrangement allows a very wide rearward field of fire for the movable gun. One disadvantage, however, is presented, in that the machine is not so easily manoeuvred on the ground. This handicap is overcome by the provision of wheel brakes and a tail wheel.

The controls are of the conventional stick and rudder bar type, and all joints are provided with ball bearings. A cross axle type undercarriage, using two Vickers oleo pneumatic legs is fitted. The extremities of the axle are hinged by radius rods to two rigid Vee's interconnected





by a cross strut. To this Vee is attached the main wing bracing. Palmer wheels and brakes, the latter being operated by pedals on the rudder bar, are usually provided.

Almost any air-cooled radial engine with a dry weight of approximately 882 lb. and with a power of from 500 h.p. to 600 h.p. may be fitted. In the prototype a "Jupiter VII" engine was used, but later this was changed for a Bristol "Mercury IV S.2" of 540 h.p. with a corresponding increase in performance. Two electron fuel tanks of 37 and 31 gallons capacity are carried beneath the centre section, supplemented by one gravity tank of 10 pints capacity. There is one engine-driven fuel pump and one hand pump is provided.

Like the majority of modern two-seater fighters, the K.47 is armed with two fixed machine guns and a movable gun over the rear cockpit. Space for about 1,000 rounds per gun, in standard metal clip belts, is provided behind the fireproof bulkhead. Any standard machine gun, such as the Vickers, Madsen or Colt, may be installed. The equipment of the gunner's cockpit differs greatly from that of conventional two-seaters. When standard ring mountings are used in high-speed aircraft, difficulties arise as a result of the air pressure against gunner and guns, and to the acceleration due to sharp turns or steep banks. In order to cope with present conditions, the K.47 is fitted with a "cradle mounting." This consists of a pivoted

mounting carrying at one end the gun and the other the gunner's seat. The mounting is so balanced that it gives the gunner a slight excess of weight, thus enabling him by means of pressure with his feet to rock the whole device up and down. The performance figures given in the accompanying table apply to the K.47 fitted with the Bristol "Mercury IV S.2" engine. When fitted with the Pratt & Whitney "Hornet S.2-V1," the maximum speed at 7,874 ft. (2 400 m) is 192.6 m.p.h. (310 km/h.), and the cruising speed at 7,874 ft. (2 400 m) is 163.4 m.p.h. (263 km/h.).

#### JUNKERS K. 47

Span .. .. .	41 ft. (12.4 m)
Length .. .. .	27 ft. (8.8 m)
Height .. .. .	8 ft. 10 in. (2.9 m)
Wing area .. .. .	250 sq. ft. (23.5 m <sup>2</sup> )
Weight, empty .. .. .	2,540 lb. (1 150 kg)
Disposable load .. .. .	1,320 lb. (600 kg)
Wing loading .. .. .	15.5 lb./sq. ft. (73.1 kg/m <sup>2</sup> )
Power loading .. .. .	7 lb./h.p. (3.2 kg/h.p.)
Maximum speed at 13,120 ft. (4 000 m.) .. .. .	200 m.p.h. (324 km/h.)
Cruising speed at 13,120 ft. (4 000 m.) .. .. .	171 m.p.h. (276 km/h.)
Climb to 3,280 ft. (1 000 m.) .. .. .	2 min.
Climb to 13,120 ft. (4 000 m.) .. .. .	8 min.
Service ceiling .. .. .	31,824 ft. (9 700 m)
Absolute ceiling .. .. .	32,808 ft. (10 000 m)
Range .. .. .	420 miles (675 km)

## T.M.A.C. EXHIBITION AND DISPLAY

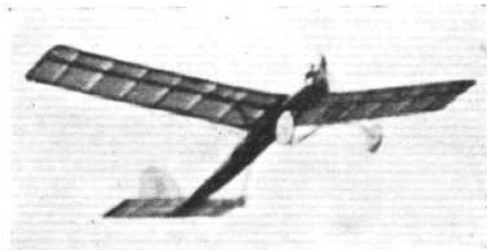
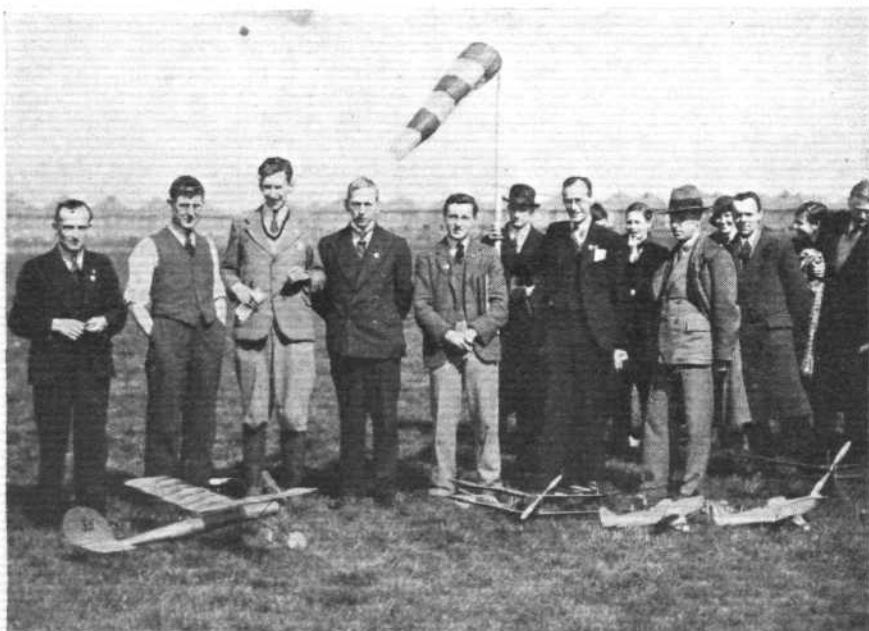
**M**ODELS. The word is by no means intriguing, nor does it stir up any great emotion in the common breast. There is, however, a certain select but ever-growing community in whose members the making and flying of model aircraft is a deep-rooted passion. Some very proficient examples of these craftsmen belong to the Model Aircraft Club.

At Stag Lane Aerodrome during the week-end the Club held two very successful meetings. On Saturday, Kathleen, Countess of Drogheda, C.B.E., opened an exhibition of models and photographs of aircraft. We have not the space for detailed praise and criticism of specified exhibits, but we feel we must congratulate Messrs. Andrews, Collins, Bennett, Knight, Brien Thomas and Fergus on their skill. The majority of the scale models were, as far as we could judge, correct in their main proportions. They were spoiled, however, in many cases, by slovenly detail work.

On the next day, Sunday, a perfect day, the model fly-

ing competitions were held. Fully 1,000 visitors arrived during the day and expressed their unqualified admiration of the performance of the models. The programme opened with a parade of model aircraft, which was followed at intervals by various contests. The following are the winners of the contests:—Duration Competition, Lt. Com. R. F. Pink; Scale Model Competition, J. Collins; Take-off Competition, H. Henry; Steering Competition, F. Baggs.

Three large petrol-engined models were present. These were a scale model of a "Gipsy III Moth," which was unable to fly owing to engine trouble; a high-wing monoplane owned by Mr. E. Holmes, which behaved very well in the air; and a biplane of 8 ft. 6 in. span, driven by a 30-c.c. four-stroke Grayson engine. Mr. R. J. Trevethick had three of his compressed-air models there, one of which is shown in flight in the accompanying illustration.



**T.M.A.C. AT STAG LANE :** In the group are shown (l. to r.) M. Knight (Assistant Hon. Secretary), R. J. Trevethick (Chairman), R. E. Gustine (Organising Secretary, 3rd Group), A. E. Jones (Hon. Secretary), S. C. Perry (Hon. Secretary, 3rd Group), J. G. Portsmouth (Chairman, 3rd Group), W. Rigby (Hon. Technical Secretary) and H. W. Bexley (Group Leader, 6th Group). On the right we see Mr. Trevethick's compressed-air model in flight.

(FLIGHT Photo.)

### First woman F.R.Ae.S.

MISS L. CHITTY, who up to recently has been working in the Engineering Laboratory of the Oxford University, is very well known for the work she has done in connection with the stressing of airship structures ever since 1922. For a number of years she has worked with Prof. R. V. Southwell, both at Cambridge and Oxford, gaining, jointly with him, the R.38 memorial prize a few years ago for

"A contribution to the analysis of primary stresses in the hull of a rigid airship." Miss Chitty is also the author of several publications dealing with this matter. By becoming a Fellow of the Royal Aeronautical Society she has been elected to the ranks of those whose work in connection with the design of aircraft structures the Royal Aeronautical Society consider worthy of their highest form of membership.

# Airport News

## CROYDON

**L**AST week the Grand National loomed large in air affairs here. The Main Hall, rendered gay by the newly opened central kiosk displaying brightly-coloured chocolate boxes and periodicals, was thronged with strong men festooned with racing glasses and beautiful women, *en route* for Aintree. Imperial Airways, Ltd., had some fifty passengers for the race, who were expeditiously and comfortably conveyed to Liverpool in a "Heracles," piloted by Mr. Youell, and an "Argosy," the *City of Manchester*, by Mr. Tweedie.

An incident connected with the Grand National was a telephone call from London at 11 a.m. by a passenger half-an-hour too late for the race specials. He was accommodated in an air-taxi piloted by Mr. Crundall, of Air Taxis, Ltd., and was in the air by 11.50. On the return journey, being unprovided with wireless, the taxi pilot "hitched his wagon to a star"; in other words, to Mr. Youell in charge of the "Heracles," and was brought to Croydon, where he and the two "Imperial" machines landed after dark.

Mr. J. H. Whitney, whose horse came in third in the great race, 'phoned Olley Air Services, Ltd., by transatlantic 'phone to have a machine at Cherbourg to await the arrival of his boat from New York. Capt. Olley arranged for the job to be done by Imperial Airways, Ltd., because he himself was engaged on a taxi flight handed over to him by his late company. The boat berthed at Cherbourg at 7.30 a.m., and Mr. Whitney was flying towards Liverpool by 7.50 a.m. He arrived at his destination about 10 a.m.

Meanwhile Capt. Olley was busy showing the Mayor and six other municipal officers of Carlisle what could be done in a short time with a fast modern air liner of the smaller type. The municipal officials breakfasted in Carlisle, lunched in Douglas, Isle of Man, had tea at Belfast, and finally returned to Carlisle for dinner. The D.H. "Dragon" of Olley Air Services, Ltd., was used for this round trip.

A passenger who has made frequent use of the K.L.M. connections with Holland, going across either at 7 a.m. or 9 a.m. and returning by the machine arriving at Croydon at 8.30 p.m., informed me that the lighting of the machines was excellent, and better to read and write by than the average Pullman car lighting. The heating also struck him as just right.

One day last week the Prime Minister of Iceland and his wife travelled to Copenhagen by the Scandinavian Air Express, leaving Croydon 9 a.m. and reaching Copenhagen 4.10 p.m. Several Salvation Army notabilities in uniform were seen going aboard the same machine.

I am told some of the air taxi companies find the "Zone" system of traffic control at this airport unneces-

sarily irksome, and have presented their case to the Director of Civil Aviation. Everything possible will no doubt be done for them, but it is quite time it was realised that everybody who will take the absolutely necessary precautions has equal rights and equal treatment on the air lanes leading to and from the commercial Airport of London. The necessary equipment, equivalent to headlamps on a car at night on any main road, is wireless. Those who cannot, or will not, fit it can hardly expect to penalise those who do.

I heard of a man who was holding forth recently about how much safer train travel was than travel by commercial air services, who was completely silenced by a paragraph read out of the day's paper about an engine axle breaking and disaster only being averted because the train was slowing up to enter a station. More and more people are beginning to regard air travel as the safest as well as the best means of travel.

A. VIATOR.

## HESTON

**B**A.N.C.O.'s Trimotor Ford took a party to the Grand National on March 23, with England's first air hostess, Miss Paddy Naismith, a racing driver and Heston-trained pilot, presiding in its comfortable interior. The daily newspapers and the menu for lunch were placed before each seat. The machine left Heston with a full load of passengers.

The Marquis de Chateaubrun flew his "Gull" ("Gipsy Major") to England on March 17, for a few necessary adjustments by the makers before the installation of a more powerful engine. He has decided upon a French power unit, a 6-cylinder 180-h.p. Regnier, and it will be interesting to hear performance figures when this alteration has been carried out. After he had given the necessary instructions at Heston, Mr. Stace, of Birkett Air Service, flew him in his own machine to Croydon in time to leave for Paris by Air-France at 3.30.

Capt. John Foltmann, of the Danish Flying Corps, who is the editor of *Flyv*, the official organ of the Royal Danish Aero Club, visited Heston a few days ago and spent nearly two hours talking over flying matters with the Club Secretary. He expressed great interest in the layout and activities of Heston, and it was difficult to convince him that private enterprise, without Government assistance, had been responsible for so flourishing a concern. He pointed out the contrast in the present state of private flying in Denmark, where all, or nearly all, civil aerodromes are Government-owned and the majority of aeroplanes are imported from England.

The school flying hours for the whole of March, 1933, were already surpassed by March 18, 1934. New pupils include two Germans, Herr W. H. Menne and Herr H. Pabelick.

## An aerodrome for Nagpur

WING COM. R. A. C. COOPER, of Delhi, has approved a site near the Gorenwara catchment area, on the Nagpur-Katol road, for the proposed Nagpur aerodrome, and has asked the local Government to transfer the land to the Nagpur Flying Club. So far, Nagpur has been without a landing ground.

## A new Belgium aerodrome

A LANDING ground for light aeroplanes is to be laid out on the outskirts of Hofstade-Plage, a summer resort about 12½ miles from Brussels and three miles from Malines. A special air service with Antwerp and Brussels is planned. Three small aircraft will be used for this purpose.

## West Malling aerodrome

FOLLOWING the change of ownership at West Malling, considerable improvements have been effected in the club and in the accommodation provided for aircraft. After Easter a new club will be formed and two "Moths"

("Gipsy") will be available for instruction. A squash court is being provided which should be ready in about two months' time. The Managing Director is now Mr. W. G. Laidlaw, the Pilot Instructor Mr. L. G. Kirschner and Mr. L. Y. C. Petts, Chief Engineer. There will be no official opening ceremony as the aerodrome is already well known, but later in the season a display will be organised. The Management will at all times welcome private owners and members of other clubs who care to fly over.

## The Deutsch de la Meurthe Cup Race

THIRTEEN entries for the Deutsch de la Meurthe Cup Race had been filed with the Aero Club of France when the time limit expired on March 15 last. The list was as follows:—Henry Potez Aeroplane Co. (2), Farman (1), Rene Caudron (4), Emil Regnier Company (1), Marcel Marshal (1), Royal Aero Club of Great Britain (1), Royal Aero Club of Italy (3). The race will be flown over a course starting and finishing at the Etampes Aerodrome, similar to that of last year. It will consist of two sections of 621.4 miles (1 000 km.), each with an hour's interval between them.



# Correspondence.

*The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.*

## BRITISH v. AMERICAN AIR LINERS

[2918] Comparisons of widely differing types of aircraft are always difficult. A bias one way or the other may be indulged to any extent by the simple process of selective suppression or omission of characteristics. Mr. Long, in his letter on the D.H.86 in your last issue, appears to imply that some indulgence in this exercise is permissible, but I am more interested in the technical aspect of some of the points raised than in any comparative or controversial matters. The mistake in the landing speed of the D.H.86 which he used was corrected in the next issue of FLIGHT. In view of the very great divergencies between on the one hand true, and on the other A.S.I.; readings or advertised landing speeds—in some cases 20 per cent. out at large incidences—it is rather better to compare surface loadings and allow for flaps, etc. This figure is 15.3 lb./sq. ft. for the D.H.86.

So far as wood, fabric and three-ply are concerned, recovering with fabric every three years is cheap and easy. Properly protected three-ply is durable in any climate. There are some highly specialised and artificial conditions which are bad for woodwork, and there are some natural conditions very damaging to thin metal. Metal construction, though promising, has yet to establish itself economically as the equal of wood, taking into account first cost, the obsolescence period, maintenance, etc. It cannot be said that there is a "best." The choice depends on all the factors to be considered in the design, construction and operation.

The span of the D.H. 86 is equivalent to a monoplane of 72 ft. span. It was difficult to follow your correspondent's thought on this point. It is this dimension—

□ □ □

## New Australian aircraft manufacturers

At Sydney (Mascot) a company known as Turgan Aircraft, Ltd., with a capital of £10,000 has been formed. The managers are Messrs. Ture, Gannon and J. C. Carpenter. It is the intention of the company to produce ultra-light aircraft.

## Making young Holland air-minded

The newly organised Netherlands Association of Youth Air Clubs (Ned. Ver. van Jeugd Luchtvaart Clubs) is making good progress in its campaign to spread air-mindedness among the young people of Holland. Already there are fourteen such clubs in Holland, while they will be established in twenty more towns in the near future, and the number of members, both boys and girls, already approaches the 1,000 mark. On April 7 the Association is organising a big propaganda day at Amsterdam, and reports from local centres reflect the great interest which the proposal has aroused. The day will begin with a free performance of the film "With the K.L.M. from Amsterdam to Batavia" at the Rialto Cinema, followed by a charabanc trip out to Schiphol, where lunch will be taken in one of the large hangars. The K.L.M. are lending a number of their staff to act as guides round the aerodrome, and every youngster will have the opportunity of a short joy-ride over the city. The organisers will have more than two hundred prizes to offer to the winners of the various competitions which will test the young people's knowledge of aircraft and aviation.

## The Federation Nationale Aeronautique: New president

At a meeting of the Board of Trustees of the Federation Nationale Aeronautique (Associated French Aero Clubs), held on March 16 last, M. Laurent-Eynac, former Air Minister, was elected President to replace M. Roudolph Sorreau, who had served during the past five years, the term allowed by the constitution. M. Laurent-Eynac, the new President, is well known to the aeronautical world. After having served as Under Secretary of State for Aviation during several years, he was appointed Minister in

obtained on a relatively low structure weight and head resistance with a large and comfortable cabin—which has permitted the desired characteristics (omitted largely by Mr. Long) to be obtained, such as the ability to fly with one engine dead at 15,000 ft.; the ability to clear the "screen" by more than double the required height with fixed-pitch propellers on full load, the large reserve of power available, and so on.

I will present Mr. Long with some free ammunition for use when he has transferred himself to the other side of the fence to which he refers and wants to deal with someone else by the method of comparisons. He could credit the D.H. 86 with the extra pay load (less the additional structure weight) obtainable by loading it up so that it would only just comply with take-off requirements when using controllable-pitch propellers. This would be a rather staggering figure. He could also supercharge the engines and raise the top speed (already 175 m.p.h.), or he could reverse the process by requiring others to have larger cabins or better take-off, etc. Or if he were dealing with some of the work done in Canada where a lower cruising speed is sufficient, he could leave off two of the engines (this has been done in effect by taking off two propellers); or use "Gipsy Majors" and have a good "pay load per h.p."

I am only trying to indicate that comparisons made in this way are without value and almost without meaning. One thing can, perhaps, be agreed upon, and that is that America has made, and is making, striking advances on all sides in civil aviation.

L. L. WALKER.

Stag Lane, Middlesex.

March 26, 1934.

□ □ □

September, 1928, when the Air Ministry was first formed. He developed its organisation and served as Air Minister for several years. M. Laurent-Eynac is a member of the Aeronautical Committee of the Chamber of Deputies and of the Board of Governors of the Aero Club of France. The Federation has had a remarkable development, under M. Sorreau's leadership during the past five years. At the end of 1929 there were only about 150 licensed private pilots in France. There are about 1,500 air tourists to-day and over 700 pilot licences were issued during 1933 by the Aero Club of France. The number of private aeroplanes has increased from about 50 in 1929 to over 700 machines at the end of 1933.

## Brown Brothers' aviation department

At the 37th Ordinary General Meeting of Brown Brothers, Ltd., held on March 16, Mr. J. Albert Thomson, J.P., Chairman and Managing Director of the company, said, concerning Brown Brothers' aviation department:—Our aviation department has made considerable progress, and we have secured a larger number of Air Ministry contracts during the year. We can claim to-day that our aircraft parts are incorporated in every British-made aeroplane which is seen in the sky. It may be of interest also to mention that the new yacht, the *Endeavour*, which is being built for Mr. Sopwith to challenge the holder of the America's Cup, will be fitted with a number of aircraft parts of our manufacture. We have had a record year for the export of aviation goods, having supplied considerable quantities to various Colonial Governments and to foreign aircraft constructors.

We have recently created a new department for the supply of aircraft specification metals, and it is hoped that our stocks will fulfil a useful purpose by enabling aircraft builders to secure immediate delivery of metals which in the past have had to be specially manufactured against specification, with resulting delays. Reference has been made in the Press to the possibility of our establishing in Hull a factory for aircraft parts, but this is not correct. Our works in North London are quite adequate for our requirements, and we may mention that all our aircraft business is handled from Great Eastern Street.

# THE ROYAL AIR FORCE

London Gazette, March 20, 1934

## General Duties Branch

Group Capt. F. E. T. Hewlett, D.S.O., O.B.E., is placed on retired list at his own request (March 15); Flt. Lt. L. Eardley-Wilmot is placed on retired list (March 20). The follg. Flight Lieutenants are transferred to Reserve (March 15):—Class A—A. L. R. Duke, C. Feather, N. A. West. Class C—H. R. Lowry.

The follg. Flying Officers are transferred to Reserve (March 15):—Class A—D. R. C. B. de Sarigny, H. E. Mayes, J. S. D. Miles, C. V. Ogden, G. J. Pawson, C. M. Rees, H. A. Shotter, A. J. Tunnard. Class C—A. C. P. Westhorpe.

F/O. H. S. Martin relinquishes his short service commn. on account of ill-health (March 15).

## Legal Branch

Flt.-Lt. on probation J. B. Walmsley, D.F.C., is confirmed in rank (Jan. 16).

## ROYAL AIR FORCE RESERVE RESERVE OF AIR FORCE OFFICERS

### General Duties Branch

The follg. Pilot Officers on probation are confirmed in rank:—H. N. E. Salmon (Jan. 27); J. D. Kirwan (Feb. 16).

P/O. on probation S. W. Fitt is transferred from Class C to Class AA (ii)

(March 16); F/O. E. G. D. Stewart, M.C., is transferred from Class A to Class C (March 5); P/O. E. B. Nelson is transferred from Class AA (i) to Class C (March 17). The follg. Flying Officers relinquish their commns. on completion of service:—H. T. Andrews (March 1); G. A. G. Bowden (March 18).

## Medical Branch

Flt.-Lt. J. P. Hederman, L.R.C.P. and S., is transferred from Class D (ii) to Class D (i) (Feb. 23).

## SPECIAL RESERVE

### General Duties Branch

C. W. Rees is granted a commn. as Pilot Officer on probation (Feb. 18).

## AUXILIARY AIR FORCE

### Stores Branch

No. 601 (COUNTY OF LONDON) (BOMBER) SQUADRON.—R. W. Stewart (Flt.-Lt., R.A.F., Retd.) is granted a commn. as Flt.-Lt. while serving as Civilian Stores Officer with the Auxiliary Air Force (Feb. 25).

## ROYAL AIR FORCE INTELLIGENCE

**Appointments.**—The following appointments in the Royal Air Force are notified:—

### General Duties Branch

**Wing Commanders:** J. C. Russell, D.S.O., to No. 502 (Ulster) (B) Sqdn., Aldergrove, 12.3.34, to Command. P. C. Sherren, M.C., to No. 1 Armament Training Camp, Catfoss, 27.2.34, to Command.

**Squadron Leaders:** G. Martyn to No. 3 (F) Sqdn., Upavon, 9.3.34, to Command vice Sqd. Ldr. C. A. Stevens, M.C. A. P. Davidson to H.Q., Palestine and Transjordan, Jerusalem, 8.3.34, for Air Staff Intelligence duties vice Sqd. Ldr. F. O. Soden, D.F.C. G. R. A. Deacon, M.C., to Wireless Station, Ismailia, 8.3.34, for Signals duties vice Sqd. Ldr. C. W. Attwood. G. F. Smylie, D.S.C., to H.Q., R.A.F. Middle East, Cairo, 8.3.34, for Equipment (Engineer) Staff duties vice Sqd. Ldr. A. O. Lewis-Roberts, D.F.C.

**Flight Lieutenants:** C. E. St. J. Beamish, to No. 3 Armament Training Camp, Sutton Bridge, 4.3.34. R. A. R. Mangles, to No. 2 (A.C.) Sqdn., Manston, 6.3.34. A. W. Sandeman, to No. 56 (F) Sqdn., North Weald, 9.3.34. T. G. Bird to Sch. of Tech. Training (Men), Manston, 9.3.34. N. Carter to No. 60 (B) Sqdn., Kohat, India, 8.3.34. R. W. M. Clark to No. 14 (B) Sqdn., Amman, Palestine, 8.3.34. J. L. Kirby to No. 99 (B) Sqdn., Upper Heyford, 10.3.34. P. W. Lowe-Holmes to Air Armament School, Eastchurch, 12.3.34. C. Snow to No. 1 Armament Training Camp, Catfoss, 11.3.34. R. W. K. Stevens to No. 208 (A.C.) Sqdn., Heliopolis, Egypt, 8.3.34. J. A. Tindall to Oxford University Air Sqdn., Abingdon, 10.3.34. T. C. Traill, D.F.C., to No. 4 Flying Training School, Abu Sueir, Egypt, 8.3.34. H. H. V. Tristram to H.Q., Air Defence of Gt. Britain, Uxbridge, 12.3.34. S. Upton to Station H.Q., Amman, 8.3.34.

**Flying Officers:** H. I. Dabinett, to No. 500 (County of Kent) (B) Sqdn., Manston, 9.3.34. C. M. H. Outram, to R.A.F. Base, Gosport, 8.3.34. P. S. H. Ross, to School of Naval Co-operation, Lee-on-the-Solent, 8.3.34. W. E. Rankin to H.Q., Air Defence of Gt. Britain, Uxbridge, 12.3.34.

**Pilot Officers:** Viscount Acheson to No. 4 (A.C.) Sqdn., S. Farnborough, 11.3.34. W. B. Murray to No. 20 (A.C.) Sqdn., Peshawar, India, 8.3.34. D. A. Pemberton to H.Q., Palestine and Transjordan, Jerusalem, 8.3.34.

**Acting Pilot Officers:** J. S. Bartlett to No. 101 (B) Sqdn., Andover, 11.3.34. E. H. P. Clarke to No. 13 (A.C.) Sqdn., Netheravon, 11.3.34. P. H. Dutton to No. 4 (A.C.) Sqdn., S. Farnborough, 11.3.34. N. D. Gilbert-Smith to No. 16 (A.C.) Sqdn., Old Sarum, 11.3.34. J. R. Gillman to No. 13 (A.C.) Sqdn., Netheravon, 11.3.34. W. T. King to No. 16 (A.C.) Sqdn., Old Sarum, 11.3.34. F. M. Loudon to No. 9 (B) Sqdn., Boscombe Down, 11.3.34. J. J. McCarthy

to No. 58 (B) Sqdn., Worthy Down, 11.3.34. H. J. Maguire to R.A.F. Base, Calshot, 11.3.34. S. T. Misselbrook to R.A.F. Base, Calshot, 11.3.34. D. C. Oliver to R.A.F. Base, Calshot, 11.3.34. H. W. A. Oloff de Wet to No. 10 (B) Sqdn., Boscombe Down, 11.3.34. J. A. K. Pettit to R.A.F. Base, Calshot, 11.3.34. F. C. Scott to R.A.F. Base, Calshot, 11.3.34. G. P. Seymour Price to No. 7 (B) Sqdn., Worthy Down, 11.3.34. C. R. Taylor to R.A.F. Base, Calshot, 11.3.34. H. West to No. 32 (F) Sqdn., Biggin Hill, 11.3.34.

### Stores Branch

**Flight Lieutenants:** F. E. R. Dixon, M.C., to Station H.Q., Amman, 8.3.34. F. C. B. Hichens to H.Q., R.A.F. Middle East, Cairo, 8.3.34. F. A. R. Smith to R.A.F. Depot, Middle East, Aboukir, 8.3.34.

**Flying Officer** D. Stephenson, to Station H.Q., Hendon, 12.3.34.

### Accountant Branch

**Wing Commanders:** A. G. N. Belfield, O.B.E., to H.Q., R.A.F. Middle East, Cairo, 8.3.34, for duty as Command Accountant, vice G./Capt. H. J. Down. P. A. Simmons to R.A.F. Depot, Middle East, Aboukir, 8.3.34, for Accountant duties.

**Flying Officers:** J. A. Stephenson, to Station H.Q., Ramleh, 8.3.34. D. A. K. Yiend to H.Q., R.A.F. Middle East, Cairo, 8.3.34.

### Medical Branch

**Flight Lieutenants:** A. S. Burns, to Station H.Q., Worthy Down, 12.3.34. T. V. O'Brien, to No. 3 Armament Training Camp, Sutton Bridge, 10.3.34. G. H. J. Williams, to R.A.F. General Hospital, Palestine and Transjordan, Sarafand, 8.2.34.

**Flying Officers:** H. Bannerman, to Central Flying School, Wittering, 12.3.34. I. Mackay, to No. 5 Flying Training School, Sealand, 12.3.34. W. P. Stamm, to No. 3 Flying Training School, Grantham, 12.3.34.

## NAVAL APPOINTMENT

The following appointment has been made by the Admiralty:—

**Lt.-Com. (Flt. Lt., R.A.F.).**—J. Wyatt Hale, to *Victory* for R.A.F. Base, Gosport (March 22).

## RUGBY SERVICES TOURNAMENT: R.A.F. versus ARMY

**T**HE Army beat the Royal Air Force at Twickenham on Saturday, March 24, by one goal and three tries (14 points) to a try (three points). The Army thus retains the Services championship.

After seeing the Navy run wildly away from the Air Force, scoring pretty well as they pleased against a side which could not tackle low, and then seeing the Army beat the Navy soundly in a hard exciting game, every one expected a substantial victory for the Army in the last match of the series. The score indicates a substantial victory, and so seems to confirm expectations. As a matter of fact, the run of the play was a complete surprise, for the R.A.F. reached the top of their form and shook the Army so roughly that at times the supporters of the military were almost frightened about the result. The outstanding feature of the play was the resolute tackling of the R.A.F. outsiders, which showed that the lessons of their match against the Navy had been well learnt and digested. The R.A.F. forwards, strengthened by the inclusion of C. Beamish, who goes on improving and now almost threatens the reputation of his famous brother George, played with grim fury, and had rather the best of it in their struggle with the formidable Army pack. Consequently, though the Air Force were beaten, they went down with flags flying, and won great honour in their defeat.

The Army scored first, but it was rather a brilliant snap try, which did not represent the run of the game up to that time. McCreight made a long kick to touch near the Air Force line, and from the line out Reeves dived over for a try. Many critics held that the Army did not deserve it. In the second half the Air Force pressed strongly, and at last were rewarded by a well-deserved try. Crawford was tackled with the ball, McConnell kicked ahead and tackled Radcliffe, the Army back, and Jennings got possession and scored far out. The kick failed. Then in the last 10 minutes of the match the R.A.F. tired, and the defence became less resolute. McCreight

ran through and passed to Hobbs, who scored under the posts. McCreight kicked the goal. Then Courtenay made an opening for Cowey, and the Welsh international got the try. Finally McCreight again beat the defence and this time Crawford, the Scottish international, took his pass brilliantly and used his pace in a fine dash across the line. So, in the end, the Army vindicated its high reputation, while the R.A.F. played better than their team has played before this season. If they start next year with the realisation that hard low tackling is a *sine qua non* of success at Rugby, they should do much better than they have done this year.

The teams were:—

### THE ARMY

Lt. S. T. A. Radcliffe (R.E.), back; Lt. B. T. V. Cowey (Welsh Regiment), Lt. D. H. D. Courtenay (Royal Tank Corps), Lt. E. J. Unwin (Middlesex Regiment), and Lt. J. A. Crawford (R.E.), three-quarter backs; Lt. C. C. McCreight (R.A.) (captain) and Lt. G. J. Dean (Royal Tank Corps), half-backs; Lt. H. Rew (Royal Tank Corps), Lt. G. C. Reeves (Royal Tank Corps), Private R. L. Morgan (R.A.M.C.), Lt. D. A. Kendrew (Leicestershire Regiment), Lt. A. J. A. Watson (The Queen's Royal Regiment), Lt. P. G. Hobbs (R.A.), Sgt. A. Boast (Welsh Guards), and Lt. H. J. Sayers (R.A.), forwards.

### ROYAL AIR FORCE

F/O. R. N. McKern (Tangmere), back; P/O. D. Finlay (Northolt), P/O. N. G. Mulholland (Andover), P/O. J. S. McLean (Biggin Hill) and P/O. B. V. Robinson (Sealand), three-quarter backs; P/O. W. A. K. Igoe (Grantham) and P/O. J. L. Barker (Grantham), half-backs; Sgt. J. S. Bignal (Duxford), Lt. A. C. W. V. Reynolds (Henlow), P/O. R. H. Waterhouse (Sealand), Flt. Lt. C. E. St. J. Beamish (Eastchurch) (captain), F/O. L. W. V. Jennings (Worthy Down), P/O. R. H. S. McConnell (Calshot), Sgt. C. G. R. Lewis (Upper Heyford) and A.C.I. J. O. Holland (Upper Heyford), forwards. Referee: J. Hughes.



## AIRCRAFT COMPANIES' STOCKS AND SHARES

DESPITE Easter holiday influences, there have been many features of interest in the industrial section of the Stock Exchange, an excellent impression having been created by the reports of important companies showing larger profits and in some cases increased dividends for the past year. Shares of companies identified with the aircraft and allied trades again moved in favour of holders on balance for the month and came in for active business. Considerable interest attached to Rolls-Royce, which are 90s. 9d. at the time of writing and are being "talked" higher in the market if confident expectations of a larger distribution are confirmed. The dividend will probably be announced by the time these notes are in print. For the previous year 10 per cent. was paid, and in respect of the past year there has been an interim dividend of 5 per cent. Estimates current are for earnings of well over 20 per cent. De Havilland have been in persistent demand and show a further upward movement during the month from 40s. to 54s. 6d., the market having taken the view that there are prospects of a good increase in the dividend for the current year. Strong demand persisted for Hawker Aircraft (24s. against 22s. 9d. last month). The initial accounts of the public company are to be made up to the end of this month, and will probably be issued in June. Fairey Aviation were well maintained, and the 5 per cent. redeemable Notes found ready buyers in view of the very attractive yield of 4½ per cent. and the fact that on the basis of last year's profits their interest requirements were earned about 9½ times over. Handley Page preference show a rise on balance from 15s. 3d. to 16s. 6d. D. Napier were particularly active with a gain on the month of over 5s. The shares are now close on three times their nominal

value, but this has to be read in relation to the strong balance sheet and the prospect of a large recovery in earnings if the new engine proves successful and popular. The company's 7½ per cent. preference show a good rise to around 26s. 3d. and the 8 per cent. preference are also several shillings better. Petters ordinary and preference changed hands, but list prices are the same as a month ago. Armstrong Siddeley Development preference moved up to 24s. 4½d., the yield being considered attractive having regard to the good cover for the dividend. Vickers responded to the favourable impression created by the past year's results and at the time of writing are around 9s. 6d. on annual meeting considerations. Imperial Airways were well maintained, with strong buying in evidence on any reaction. Ford Motors advanced to 30s., a rise of over 5s. on the month. In other directions Brown Brothers were well maintained on the past year's results, it being generally recognised the 10 per cent. dividend was a very conservative payment and in view of the progressive policy followed by the company that sooner or later shareholders stand to participate more fully in its success. Joseph Lucas moved up from 60s. to 65s. 3d., partly on market expectations of a satisfactory interim dividend. S. Smith (M.A.) preferred and deferred remained prominent on favourable views of dividend prospects. At Sheffield Firth & John Brown preference showed further improvement. Oil shares reacted on the "cut" in petrol prices, which came as a surprise to the market, but are much steadier at the time of writing.

### British steel for the U.S.S.R.

AN order for 20,000 tons of steel tubes, worth approximately £1,000,000, has been placed by the Soviet Government through Arcos, Ltd. This is understood to have been distributed over a group of British tube manufacturers, and as part of the order is required for aircraft work, we are not surprised to see the name of Accles & Pollock, Ltd., in the list of suppliers.

### Redwing move to Croydon

THE Redwing Aircraft Company have transferred their main activities from Colchester to Croydon and are now installed in a hangar next to Surrey Flying Services. They are well equipped to carry out overhauls and repairs to all types of aircraft, particularly, of course, the well-known "Redwing" side-by-side machine, of which they are the designers and manufacturers.

### NEW COMPANIES REGISTERED

AIR HOLDINGS, LTD., Terminal House, 52, Grosvenor Gardens, S.W.1. —Capital, £100 in £1 shares. Aerial transporters of passengers, merchandise, produce, mails, and other goods, aeronautical engineers, owners, licensees, and hirers of air and road transport, etc. Directors: Stanley Bell, White Barn, Brookwood, Surrey, engineer, director of London, Scottish & Provincial Airways, Ltd.; Wm. A. Burnside, Junior Bachelor's Club, 52, Cromwell Road, S.W.7, commercial air pilot.

PANTHER MOTORS, LTD., 91, Piccadilly, Manchester. —Capital, £2,000 in £1 shares. Manufacturers of and dealers in motor boats and ships, submarines, aeroplanes, seaplanes, airships and other aircraft, etc. Directors: John Harrop, 137, Old Hall Lane, Fallowfield, Manchester (director of John Harrop, Ltd.); Arthur G. White, 157, Mauldeth Road West, Withington, Manchester; Cyril C. Potter, Manor Drive, Didsbury, Manchester.

W. H. S. TRANSPORT, LTD. —Capital, £5,000 in £1 shares. Carriers by land, water and air, haulage contractors, cartage and general contractors, owners or managers of motor cars, and other vehicles and aeroplanes, etc., also to acquire and hold shares or other interests in or securities of W. H. Smith & Son, Ltd., Hambleden Estates, Ltd., or in any other company. Power is also taken to buy and sell news, information and pictures, and to collect and distribute the same by wireless, aeroplanes or such other means as may be thought expedient, etc. First directors Rt. Hon. Viscount Hambleden, Sir William H. Dyke Acland, Bt., Arthur W. Acland, Edward W. Seymour, Michael C. St. J. Hornby, Hon. James F. A. Smith and Hon. David J. Smith. Solicitors: Burcham & Co, 46, Parliament Street, Westminster, S.W.1.

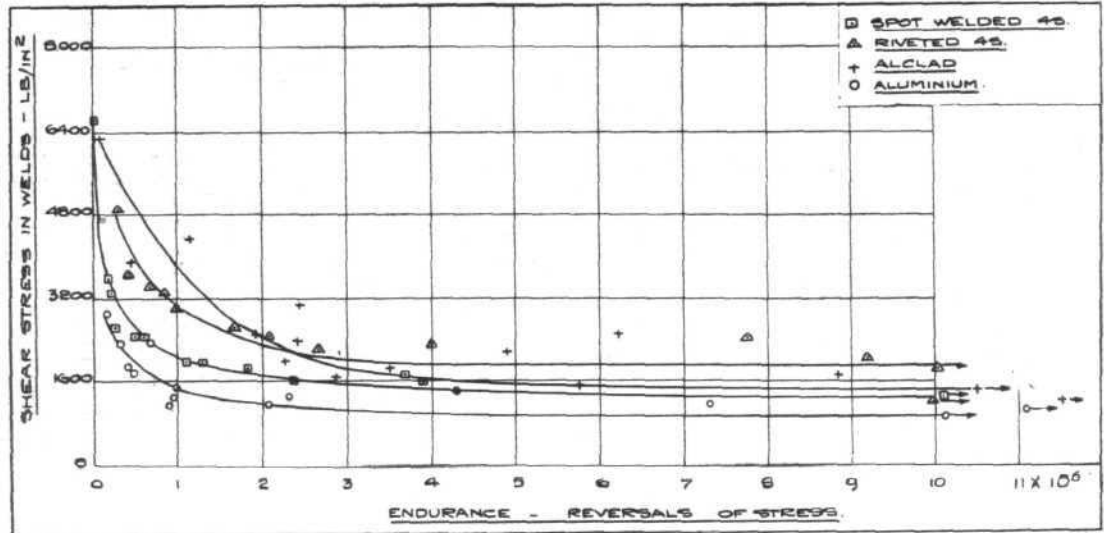
THE RAILWAY-AIR SERVICES, LIMITED, Airway Terminus, Victoria Station, S.W.1. Capital £50,000 in £1 shares. The objects are to establish and operate air transport services in the United Kingdom and elsewhere for the carriage of passengers, goods and mails, to enter into arrangements with any government, corporation, authority or person for interchange or traffic or otherwise, and to carry on the business of carriers, railway, forwarding and tourist agents, aircraft builders and repairers, etc. The directors are to number not less than 5, nor more than 10, of whom 5 shall be appointed by the Great Western, London & North Eastern, London Midland & Scottish, and Southern Railways and Imperial Airways, Ltd. (one by each Company). A letter from the solicitors, dated March 21, 1934, states "No directors have yet consented to act." Qualification: 100 ordinary shares. Solicitors: Duffield Bruty & Co., Broad Street Avenue, E.C.2.

Name	Class	Nominal Amount of Share	Last Annual Dividend	Current Week's Quotation
Anglo-American Oil	Deb.	Stk.	5½	101
Armstrong-Siddeley Develop.	Cum. Pref.	£1	6½	24/4½
Birmingham Aluminium Castg.	Ord.	£1	7½	33/-
Booth (James), 1915	Ord.	£1	15	74/9
Do. do.	Cum. Pref.	£1	7	29/-
British Aluminium	Ord.	£1	5	28/6
Do. do.	Cum. Pref.	£1	6	25/-
British Celanese	Ord.	10/-	Nil	14/6
British Oxygen	Ord.	£1c	6½	48/9
Do. do.	Cum. Pref.	£1c	6½	30/-
British Piston Ring	Ord.	£1	20	72/-
British Thomson-Houston	Cum. Pref.	£1	7	28/1½
Brown Brothers	Ord.	£1	10	49/-xd
Do. do.	Cum. Pref.	£1	7½	30/-
Dick (W. B.)	Cum. Pref.	£10	5	113/9
De Havilland Aircraft	Ord.	£1	7½	54/6
Dunlop Rubber	Ord.	c	4	52/3
Do. do.	"C" Cum. Pref.	16/-	10	29/9
En-Tout-Cas (Syston)	Def. Ord.	1/-	Nil	-7½
Do. do.	Ptg. Ptd. Ord.	5/-	Nil	3/3
Fairey Aviation	Ord.	10/-	10	28/6
Do. do.	Red. Nts.	H	5J	29
Firth (T.) & John Brown	Cum. Pref.	£1	6d	17/-
Do. do.	Cum. Pref.	£1	5* <sup>d</sup>	16/6
Ford Motor (England)	Ord.	£1	Nil	30/-
Fox (Samuel)	Mt. Deb.	Stk.	5	80½
Goodyear Tyre and Rubber	Deb.	Stk.	6½	104
Handley Page	Ptg. Pref.	8/-	10	16/6
Hawker Aircraft	Ord.	5/-	B	24/-
Do. do.	Red. Cum. Pref.	£1	B	21/9
Hoffmann Manufacturing	Ord.	£1	7½	35/-
Do. do.	Cum. Pref.	£1	7½	27/6
Imperial Airways	Ord.	£1	5	39/9
Kayser, Ellison	Ord.	£5	1	70/-
Do. do.	Cum. Pref.	£5	6	105/-
Lucas (Joseph)	Ord.	£1	25E	65/3
Napier (D.) & Son	Ord.	5/-	Nil	14/3
Do. do.	Cum. Pref.	£1	7½	26/3
Do. do.	Pref.	£1	8A	22/-
Petters	Ord.	£1	Nil	7/6
Do. do.	Cum. Pref.	£1	7½G	13/9
Roe (A. V.) (Cont. by Armstrong-Siddeley-Devel., q.v.)	Ord.	£1	—	—
Rolls-Royce	Ord.	c	10	90/9
Smith (S.) & Son (M.A.)	Def. Ord.	1/-	25	8/-
Do. do.	Pt. Ptd. Ord.	£1	14	62/6
Do. do.	Cum. Pref.	£1	7½	28/1½
Serek Radiators	Ord.	£1	12½	47/6
"Shell" Transport and Trading	Ord.	£1	7½*	52/-
Do. do.	Cum. Pref.	£10	5	£12½
Sternol	Cum. Ptd. Ord.	10/-	4F	5/6
Triplex Safety Glass	Ord.	10/-	25	82/3
Vickers	Ord.	6/6	4	9/6
Do. do.	Cum. Pref.	£1	5*	24/-
Vickers Aviation (Cont. by Vickers, q.v.)	—	—	—	—
Westland Aircraft (Branch of Petters, q.v.)	—	—	—	—

\* Dividend paid, tax free. c £1 unit of stock. d Last xd, March, 1931. A Last xd, September, 1931. n Issued last year. g Last xd, July, 19, 1932. E Also 100% share bonus. F Actual: in respect of arrears. H £25 paid. J Issued this year.

# THE AIRCRAFT ENGINEER

Fig. 14. The mechanical properties of 4S were given in a table last week. The relationship between fatigue shear stress and endurance for various materials is shown here-with. The consistency of the 4S alloy is most notable.



with the lamination, the stress distribution shown is good for a single bay biplane wing spar, but even if improvement could be obtained by modification to the detail design, the construction of a biplane spar member having the uniformity of stress indicated in curve *b* is not a feasible proposition.

"Only in really large biplane constructions would such refinements in design be possible, whereas no difficulty exists in getting the uniformity of stress shown in curve *b*, in monoplane constructions as described. At the moment we cannot proceed further than a simple monoplane wing; the word simple is perhaps a misnomer here, the calculations may, in a casual manner, be regarded as simple in comparison with what is required for a biplane structure. In the case of the monoplane, however, flutter and allied investigations become of prime importance and the additional calculations connected therewith make the matter more involved and complicated than it might at first sight appear.

"Another form of wing construction in which the whole skin or a large part of it is reinforced against considerable longitudinal forces is worth attention; in this the bending is resisted by a reinforcing combination and not by the booms of separate and distinct spars. Corrugated internal plate attached to a plain outer skin would appear to be the best arrangement, graduation in area against the variation in load could well be executed through the use of lamination in the flat skin.

There are certain manufacturing difficulties, however, which so far have precluded an experimental investigation of this construction. The main difficulty, which has been excessive riveting, is, however, likely to be overcome in the near future."

## Appendix I

### Critical Stresses of Thin Curved and Flat Plates

The formula derived by Redshaw for the critical buckling stress for a curved panel axially loaded and simply supported at axial and circumferential edges is

$$p = \{E/6(1 - \sigma^2)\} \left\{ \sqrt{[12(1 - \sigma^2)t^2/r^2 + \pi^4 t^4/b^4] + \pi^2 t^2/b^2} \right\} \dots (1)$$

$\sigma$  = Poisson's ratio,  
 $b$  = length of arc,

the other symbols having the meaning allocated in other parts of the paper.

If  $(b/t)^2$  is large in comparison with  $r/t$  the formula reduces to that obtained for the complete tube (see references in table below)

$$p = \sqrt{1/3(1 - \sigma^2)} E(t/r) \dots (2)$$

so that if the angle subtended by the panel is fairly large the critical stress is dependent only upon the curvature and thickness and not upon the length  $b$ .

If the angle is small, the above formula should be amended to

$$p = \sqrt{1/3(1 - \sigma^2)} E(t/r)F_1 \dots (3)$$

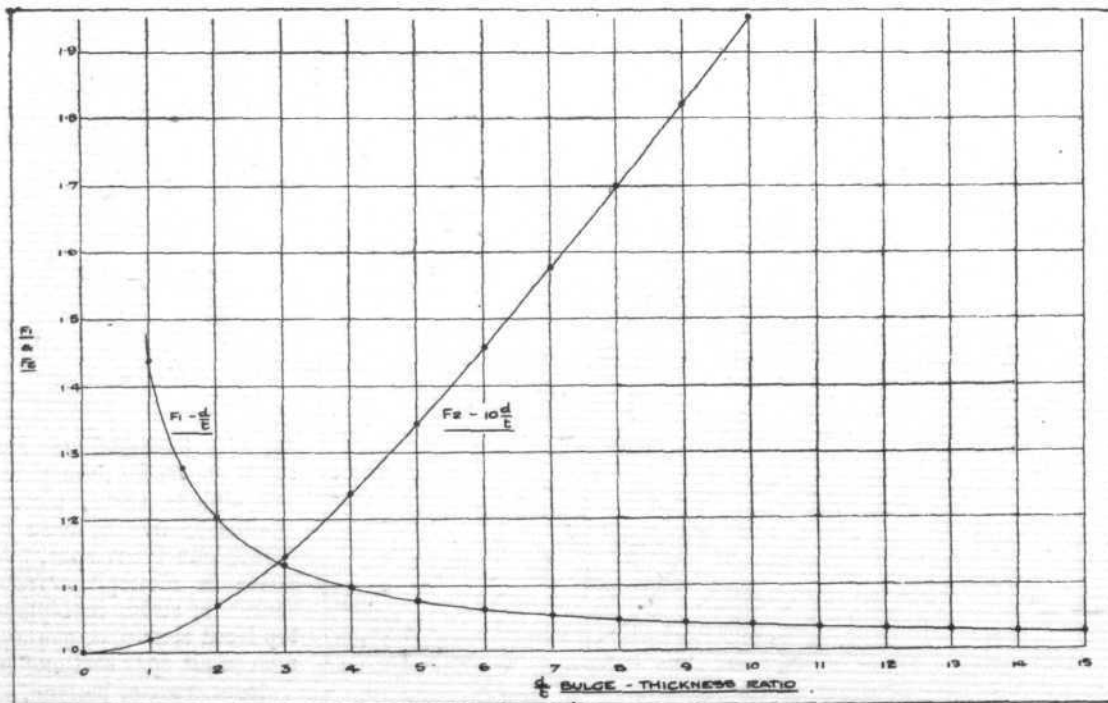
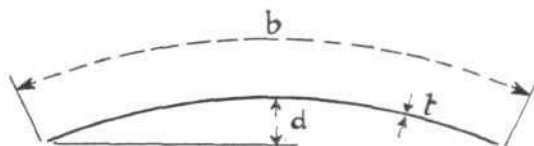


Fig. 1, Appendix I: Curves showing multiplying factors to be used in connection with the critical stresses for curved panels in compression. Based on R. & M. 1565.



# THE AIRCRAFT ENGINEER

where  $F_1 = 1 + D(t/d) + \frac{1}{2}(Dt/d)^2 + \dots +$   
 $D = \pi^2/8 \sqrt{\{12(1 - \sigma^2)\}} = 0.368$   
 $d = r\phi^2/8 = \text{"the bulge"}$



$\phi = \text{angle subtended by arc of panel.}$

If  $(b/t)^2$  is small in comparison with  $r/t$  the formula reduces to that for a flat panel

$$p = [\pi^2 / \{3(1 - \sigma^2)\}] E(t/b)^2 \dots\dots\dots (4)$$

For slightly curved surfaces equation (4) must be modified to

$$p = \{\pi^2/3(1 - \sigma^2)\} E(t/b)^2 F_2 \dots\dots\dots (5)$$

where  $F_2 = [1 + \sqrt{\{1 + 7.4 (d/t)^2\}}]/2.$

For slightly curved panels it is advisable to use formula (3), although the critical stress will be the same if formula (5) is used.

The graph shows the relationship between the multiplying factors  $F_1$  and  $F_2$  and the  $d/t$  ratios.

It is stated in the text of the paper that the theoretical critical stress given by formula (3) above was in many cases 80-90 per cent. of the collapsing load of some actual tests; in this connection, it must be remembered that the critical stress is the stress at which instability will occur, but that it is possible for a test specimen to take additional loads after the critical stress has been reached.

There is generally a discrepancy between the theoretical and actual critical stresses for most cases of instability; this is mainly due to the difficulty in reproducing the exact theoretical boundary conditions on the specimens. Another cause which is often overlooked is that in most cases the formulæ are only valid providing the limit of proportionality

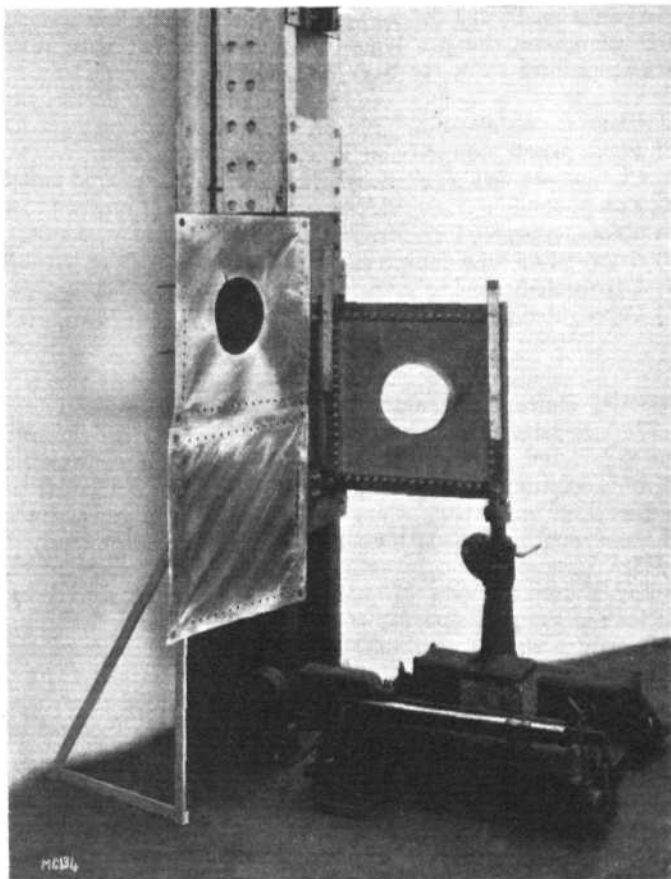


Fig. 1, Appendix II : Method of Test. Square sheets in shear.

is not exceeded. The question of *plastic instability* is of importance in certain phases of structural design and has, as yet, received little consideration.

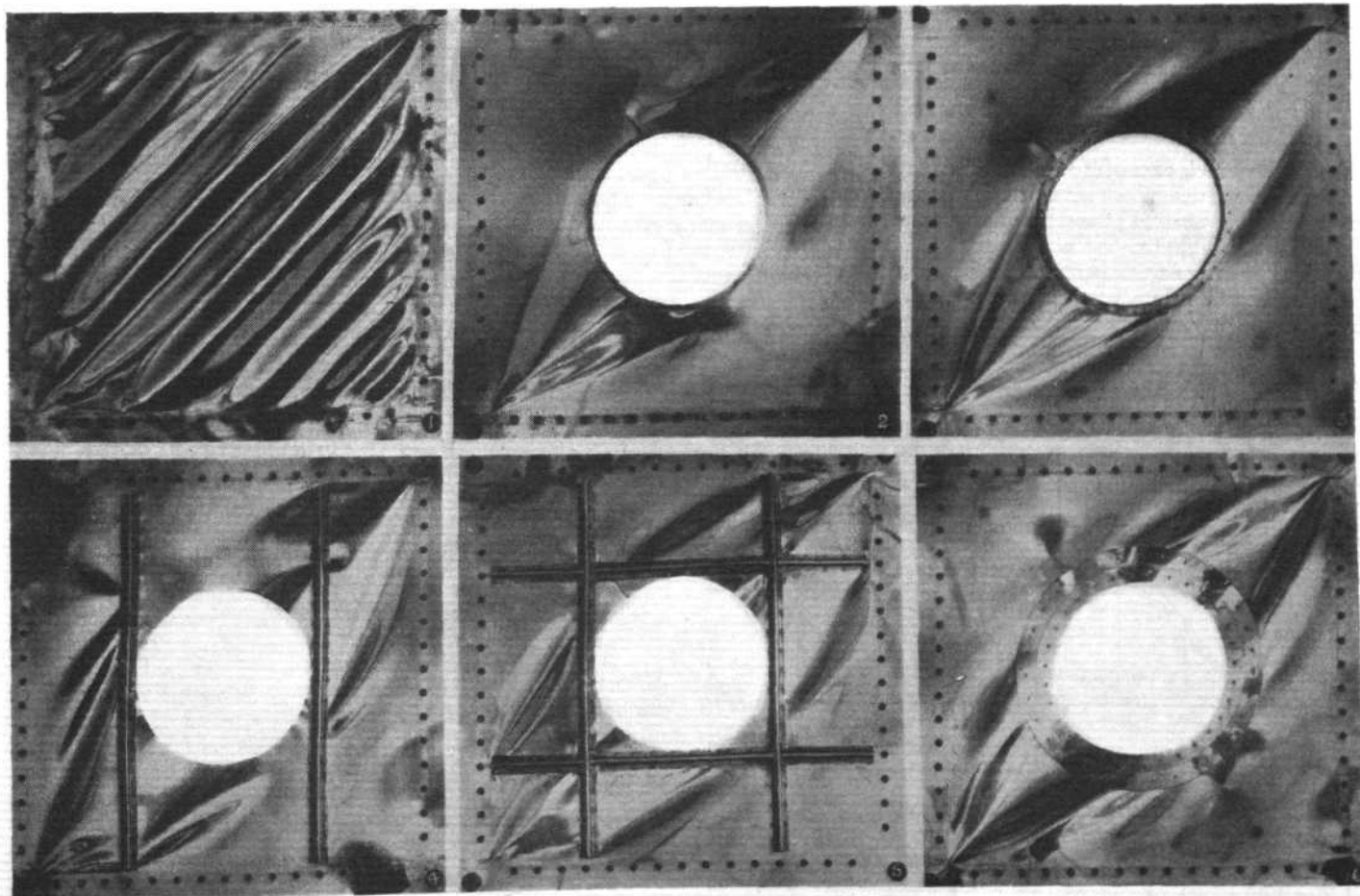


Fig. 2, Appendix II : Sequence of sheets tested. Types of failure.

# THE AIRCRAFT ENGINEER

In addition to the foregoing case, the table below shows, with references, the problems relating to critical instability that are known to me to have been solved.

		Reference
(1) Plane panels shear	... $KE(t/b)^2$ ...	17
(2) Plane panels compression	... $KE(t/b)^2$ ...	18
(3) Curved panels shear	... $KEt/r$ ...	19
(4) Tubes, torsion	... $KE(t/r)^{1.35}$ (Empiric)	20
(5) Tubes, compression	... $KEt/r$ ...	21
(6) Segment of tube compression	$KEt/r$ ...	R. & M.1565
(7) Corrugated panels shear	... $KE(t/b)^2$ ...	22
(8) Corrugated panels compression	$KE(t/b)^2$ ...	23

## Appendix II

### Effect of Holes on Strength of Panel Bracing

The necessity for the investigation of the case of lightened and reinforced plates subjected to shear forces is, at present, of more urgency than the case of similar plates subjected to end load. Unlike the former case, an approximate estimate of the strength of the latter can be made.

The purpose of this investigation is to find by how much strength and stiffness of panels in shear are reduced by cutting holes in them, and to find what forms of stiffening will restore the maximum elastic strength and stiffness for a minimum expenditure of weight.

The first part of the investigation was confined to square panels with circular holes cut in them, and the method of test is as shown in Fig. 1.

A square panel is secured to rigid bars freely pivoted at their ends. The pin centres are 22 in. apart, and the material is Alclad 0.022-in. thick.

Panels tested to date are as follows:—

- (1) Plane sheet.
- (2) Sheet with 6-in. dia. hole (unbeaded edge).
- (2) " " 9-in. " " " " "
- (3) " " 9-in. " " (weight of beading equal to weight of metal removed for hole).
- (4) " " " " " vertical stiffeners.
- (5) " " " " " vertical and horizontal stiffeners.
- (6) " " " " " two laminated rings each side.
- (7) " " " " " four laminated rings each side.

All the panels except No. 7 are shown in Fig. 2. The results shown plotted against shear load in the graph, Fig. 3, are deflections measured at and parallel to the direction of loading.

The investigation has not proceeded far enough to allow of the drawing of final conclusions. Two matters, however, are worthy of comment.

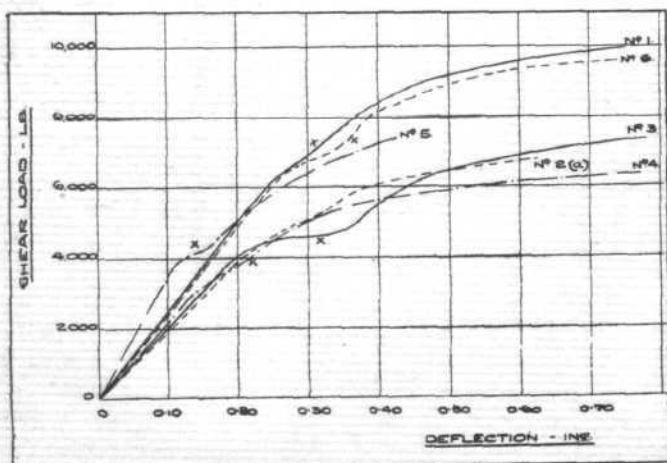


Fig. 3: Graphs showing relation between load and relative displacement of scales shown in Fig. 1, App. II. No. 1, complete panel. No. 2, panel 6 in. hole. No. 2a, panel 9 in. hole. No. 3, as 2a, edge stiffened. No. 4, as 2a, vertical stiffeners. No. 5, as 2a, vertical and horizontal stiffeners. No. 6, as 2a, laminated rings.

The sudden fall in stiffness indicated at points  $x, x$ , etc., on the curves cannot be associated with any observable phenomenon on the panel while being loaded, e.g., appearance of tension waves or their permanence.

From the aspect of restoring the greatest percentage of the original ultimate strength, the most effective type of stiffening weight for weight is laminated plates. As might be expected, the use of sectioned stiffeners (panel five, Fig. 2) results in greater stiffness over the first range of load, and this type of stiffening also gave the greatest elastic strength. The amount of elastic strength for these panels is not apparent from the curves shown in Fig. 3. This is an extremely important design consideration, the determination of the true elastic strength necessitating the use of elaborate strain measuring apparatus.

Other forms of stiffening are being tested, and subsequently the investigation is to be extended to holes of various diameters and forms, and then to the case of lightened plates under combined end thrust and shear force.

## Appendix III

### Theory of Webs of Girders

The following notes and formulae should be read in conjunction with the relevant part of the paper:—

- $f$  = Tension in the web in stress units.
- $H_t$  = Load in tension boom in force units.
- $H_c$  = Load in compression boom in force units.
- $\alpha$  = Angle of waves to horizontal.
- $V$  = Load in vertical members in force units.

Other symbols shown in Fig. 1.

$$f = 2P/ht \sin 2\alpha = 2P/ht \text{ (for } \alpha = 45^\circ \text{)} \dots\dots\dots(1)$$

$$H_{t,c} = \pm Px/h - (P/2) \cot \alpha = Px/h - (\frac{1}{2})P \text{ (for } \alpha = 45^\circ \text{)} \dots\dots\dots(2)$$

$$V = -P(d/h) \tan \alpha = -P(d/h) \text{ (for } \alpha = 45^\circ \text{)} \dots\dots\dots(3)$$

It is stated (Ref. 10, page 1) that when the load acts in one direction only or to a much greater amount in one than in the opposite direction, it pays to put the stiffeners at about  $30^\circ$  to the vertical; it is proved that the weight of the sheet web is lowered 15 per cent. and the stiffness is raised 55 per cent. by such means. The formulae for these cases follow, although it frequently happens that the external forces act for different cases in opposite directions, the total force in one direction not being greatly different from the total force in the opposite direction, thus the angle  $\beta$  (Fig. 2) for general use should be taken as  $90^\circ$ .

The following formulae apply, however, for any angle  $\beta$ , and cover the case of the stiffeners or struts (the words are used interchangeably though stiffener is probably the more appropriate) secured to the web.

$$f = (2S/ht) \{1/\sin 2\alpha(1 - \tan \alpha \cot \beta)\} \dots\dots\dots(4)$$

$$H_{TC} = \pm M/h - S/2 (\cot \alpha \pm \cot \beta) \dots\dots\dots(5)$$

$$V_1 = -[(S_L + S_R)/2] (d/h) (\tan \alpha/\sin \beta) \{1/(1 - \tan \alpha \cot \beta)\} \pm Pn/\sin \beta \dots\dots\dots(6)$$

$$V_2 = -[(S_L + S_R)/2] (d/h) (\tan \alpha/\sin \beta) \{1/(1 - \tan \alpha \cot \beta)\} \dots\dots\dots(7)$$

- $S$  = Total shear force at section considered.
- $M$  = Moment at section considered.
- $S_L$  = Shear to left of the strut under consideration.
- $S_R$  = Shear to right of the strut under consideration.
- $Pn$  = External load at the strut under consideration.

Other symbols have the meaning previously allocated or as shown in Fig. 2. Providing the spacing of the struts is not outside the limits one-half to one-sixth of the beam depth, the angle  $\alpha$  is approximately equal to  $\beta/2$ .

Since the angle  $\beta$  will, in general, be  $90^\circ$ , the formulae reduce to:—

$$f = 2S/ht \dots\dots\dots(8)$$

$$H_{TC} = \pm M/h - S/2 \dots\dots\dots(9)$$

$$V_n = -[(S_L + S_R)/2] (d/h) \pm Pn/2 \dots\dots\dots(10)$$

$P_n$  = the external force applied at the strut  $V_n$ .



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In the relevant references, formulæ covering the case of beams having struts flexible in the plane of the web sheets are quoted. In general, however, it is preferable to secure the struts to the sheet, thus securing the greatest rigidity, the proportionate increase in the strength of the struts obtained by this means is indicated below (Fig. 6 and equation 18) while the whole stiffness of the girder is raised by such fixing; the formulæ for flexible struts are therefore not given.

In addition to the stresses arising from the force calculated from equations 1, 2 and 3, bending stresses are also set up in the flanges due to the pull of the web sheet on these parts.

The stress at the point A is given as (Ref. 10, page 5)

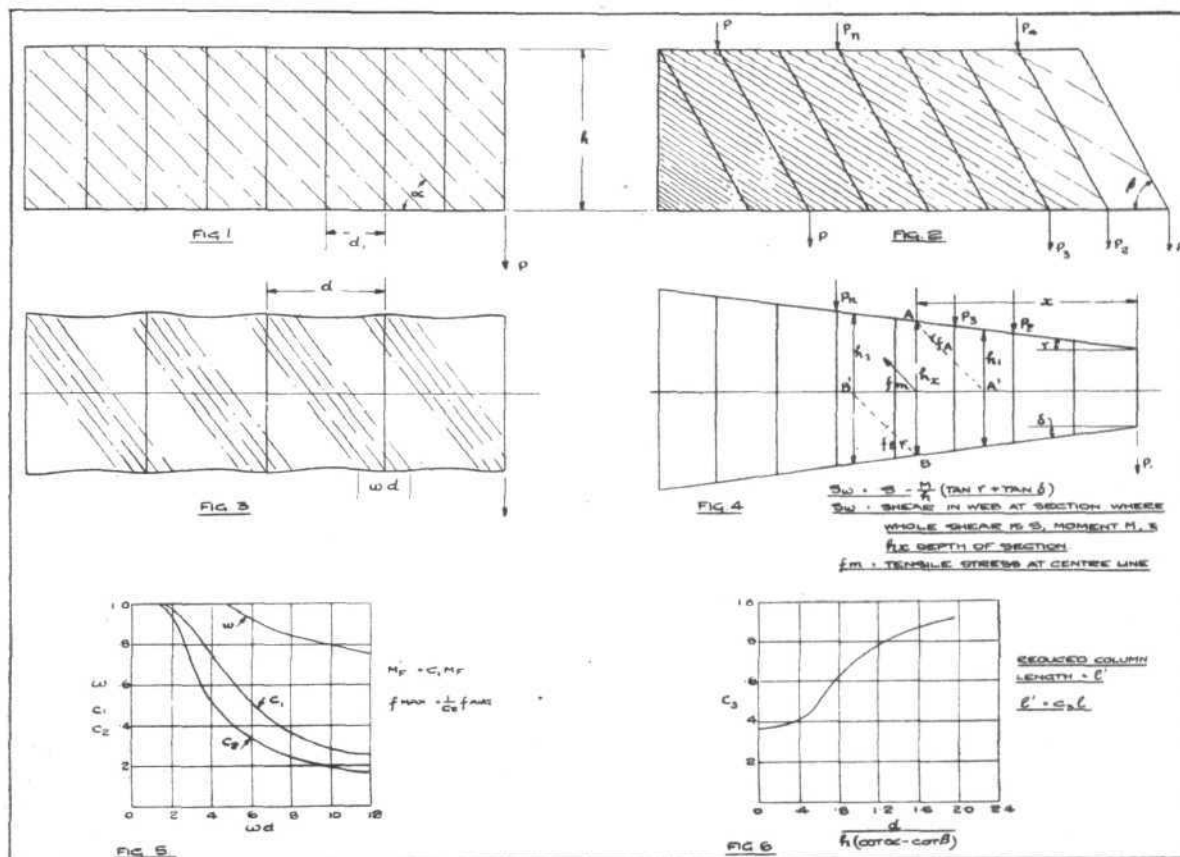
$$f_A = f_m (h_x^2 / h_1^2) = f_m / (1 - \cot \alpha \tan \delta)^2 \dots \dots \dots (15)$$

$$f_B = f_m (h_x^2 / h_2^2) = f_m / (1 + \cot \alpha \tan \delta)^2 \dots \dots \dots (16)$$

$$\text{where } f_m = (Sw/hxt) 1/\sin \alpha \cos \alpha \dots \dots \dots (17)$$

In the above, the boom angles  $\delta$  and  $\gamma$  are assumed equal.

The strength of the vertical secured to the skin is derived by means of Fig. 6. The elastic support given to the verticals, results in what is, in effect, a reduction of the slenderness ratios or a virtual reduction of lengths of those members



Appendix III : Figs 1 to 6.

The bending moment is a maximum at the points of attachment of the web struts and is

$$M_F = Sd^2/12h \cdot \tan \alpha \dots \dots \dots (11)$$

If the resistance of the flanges to bending is small then the pull of the central parts of the web becomes ineffective (Fig. 3), it is then necessary to evaluate the expression

$$wd = 1.25d \sin \alpha \sqrt{[t/(I_t + I_c)h]} \dots \dots \dots (12)$$

where  $I_t$  and  $I_c$  are the moments of inertia of the tension and compression flanges about their own centroidal axes, and from Fig. 5 to obtain a value for the constant  $C_1$ . Then a new bending moment

$$M_F^1 = C_1 M_F \text{ can be derived } \dots \dots \dots (13)$$

In the case of flexible flanges, the equation (1) gives only the average stress in the web sheet, the max. stress is

$$f_{\max} = f_{\text{average}} \times 1/C_2 \dots \dots \dots (14)$$

the value of  $C_2$  also being obtained from Fig. 5.

In most wing constructions the spars taper, thus part of the shear is taken on the flanges direct, the amount taken by the web being the difference ( $Sw$ ) of the total shear and the vertical components of the flange forces (Fig. 4). Wagner gives this case special treatment as indicated in Ref. 10, page 1, *et seq.*

The main fact established is that the web stress varies over the depth of the girder. At the same time the stress is constant along the length of any wave, thus the stress at the point A on section AB (Fig. 4) is the same as at A' and the stress at point B is the same as at B'.

and the virtual length  $l^1$  is given by

$$l^1 = C_3 l \dots \dots \dots (18)$$

$C_3$  being obtained from Fig. 6. Using this effective length and the loads  $V$  or  $V_n$  the strength of the member as a strut can be obtained from the "strut curve," allowance being made for the "effective width" of attached material.

- 17 P.R.S., Vol. 105. On the stability under shearing forces of a flat elastic strip. R. V. Southwell.
- 18 Buckling of thin plates in compression. R. & M. No. 1554. H. L. Cox.
- 19 Strength in shear of thin curved sheets of Alclad. N.A.C.A. Technical Note No. 343. G. M. Smith.
- 20 Strength tests of thin-walled duralumin cylinders in torsion. Technical Note 427. E. E. Lundquist.
- 21 P.R.S., Vol. 121. The strength of tubular struts. A. Robertson.
- 22 Z.F.M., 28/9/20. The buckling of corrugated sheet in shear. S. Bergmann and H. Reissner.
- 23 D.V.L., 6/3/31. Buckling tests on panels of corrugated sheet. E. Seydel.

## PIETZKER, NOT PESCA

In the account of the discussion of Mr. Pollard's paper published in FLIGHT last week, Mr. Langley was made to refer to Pesca's theory. Some of our readers may have been puzzled by this unfamiliar name. The author to whom Mr. Langley referred was Herr Pietzker. Reference to Pietzker's theory is made in A.R.C. R. & M. No. 1553, but there is a misprint in the reference. The analysis of Sir John Biles' experiments on H.M.S. *Wolf* in the light of Pietzker's theory was published in the Proc. Inst. Naval Architects in 1925, and not, as printed in R. & M. 1553, in 1905.

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## ENGINE COWLING

By J. D. NORTH, F.R.Ae.S., M.I.Ae.E.

(Concluded from page 14)

### Townend Rings on Pusher Engines

A Townend Ring will effectively reduce the resistance caused by an engine fitted at the rear of an aircraft body. For use under these conditions the ring chord angle requires to converge fairly rapidly to the rear, whereas for the more usual type of installation the convergence is almost invariably in the opposite sense. A ring used on such an installation is subject to a large down-wind force, whereas on the normal installation there is a large up-wind force. A reduction in drag in this case must be associated with large increases in the pressure on the rear end of the body within the ring, but the essential characteristic of the Townend Ring—that of producing a downwash which prevents the flow from breaking away—remains unaltered.

In tandem installations Townend Rings have been used on both front and rear engines. It appears that in these cases the reduction in drag which is possible is mainly that due to the front ring. In certain cases the use of a Townend Ring on the front engine of a tandem pair is stated to have very considerably improved the cooling of the rear engine—a point of very considerable importance. In view of the effect of the ring in preventing a breakaway of flow behind the engine, this effect is not altogether surprising.

### Model Tests and Full-Scale Results on Townend Rings

The Townend Ring owes its origin to investigations carried on in the wind channel with small-scale models. There is inevitably some doubt as to the direct applicability of the results of such tests to the prediction of performance for the full-scale aeroplane.

Full-scale tests of Townend Rings have now been made in sufficient numbers to place it beyond doubt that the effect shown by small-scale models also occur in the full-size aeroplane, and there is enough evidence to show that the magnitude of the saving in resistance shown by model tests is of the same order as that indicated by full-scale performance tests.

Models used for Townend Ring investigations require to be a fairly large scale. Our own experience indicates that a scale of one-fifth with a wind channel speed of 60 ft./sec. is sufficient for most purposes, but that it is dangerous to go to a much smaller scale.

It is very common practice to represent the engine on small-scale models by a conventionalised dummy engine which is arranged to give the known or assumed drag of the real engine. Such conventionalised models cannot safely be used with a Townend Ring on any scale, because the change in drag caused by a Townend Ring depends on the exact pattern of the air flow caused by the engine, and not by the engine's absolute resistance. The representation of engine installations by conventionalised models is usually extended to cover cowling details, and air passages through cowlings are either not represented at all or are replaced by a few passages drilled through the body block. Tests which have been carried out comparing the resistance of a representative model of a complete engine with the normal type of cowling accurately represented, invariably shows very much higher drags for the normally-installed engine than are given by the usual type of conventional representation.

Many comparisons between the results of model tests made by my firm and of full-scale tests showing the effect of Townend Rings are available. Where the full-scale tests show directly the change in performance due to the fitting of the Townend Ring, the correspondence between model result and full-scale test has generally been very satisfactory. Where estimates of the effect of fitting Townend Rings have had to be made from the

estimated drag of the unringed machine, no check on the real drag being available from a full-scale test with the ring omitted, the maximum speed obtained has frequently fallen short of the designer's hopes, but this characteristic is not confined to aircraft with Townend Rings, and should not be taken as evidence of their failure to produce, full scale, the saving in drag shown by model tests.

In a figure shown earlier, the model results of varying the chord angle of incidence of the Townend Ring were shown. In order to obtain if possible full-scale confirmation of these results, a variable angle Townend Ring, precisely similar to the model, was tested full scale.

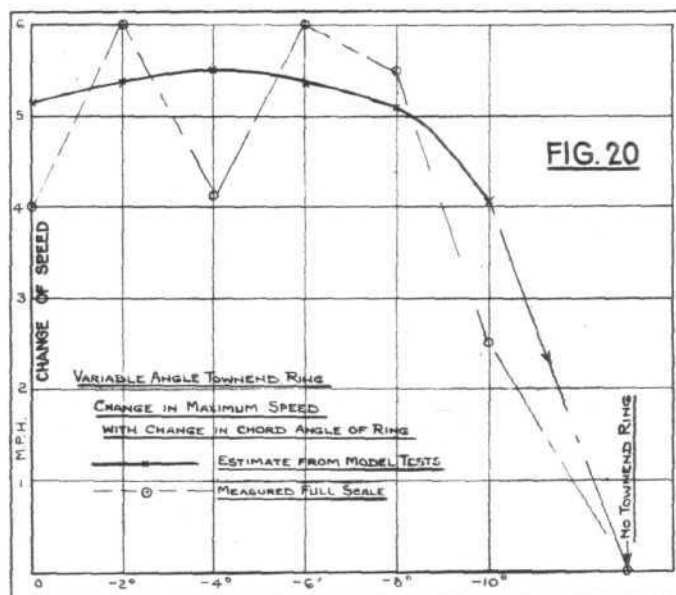


Fig. 20 shows the estimated variation in performance with ring angle, and that measured full scale. It should be noted that the full-scale results plotted are the mean of six speed readings for each ring chord angle. The total estimated change in speed between no Townend Ring and Townend Ring at its most effective setting is 15.5 m.p.h. The variation between the various measured full-scale speeds at each individual ring angle vary between 2 and 7 m.p.h. I do not regard these particular tests as showing any abnormal degree of variability.

### Total Power Plant Drag with the Townend Ring

It may be interesting to compare estimates of the drag necessary for cooling with results which have actually been obtained with the Townend Ring. The estimate made by Pye, which has been earlier mentioned, that at 150 m.p.h. about 1.5 per cent. of the total engine output must necessarily be used in providing engine cooling when the temperature difference available for heat transfer is 180 deg. C., relates only to ideal conditions which we can scarcely hope to approach in the air-cooled engine, even if the suggestion which has once been made of using streamline sections instead of circular ones for engine cylinders were found to be practicable.

McKinnon Wood, in a paper to which reference has also been made, has suggested a method of cooling which is certainly practicable, involving the enclosure of the cylinders in ducts which confine the cooling air flow to a path closely following the cylinder contour and embodying a fan so that the cooling is not dependent on the air speed of the aircraft. The use of the fan is indicated as preferable on account of the claimed self-regulating characteristics of this cooling system, and if aircraft of much higher speeds than are at present common are to be attained with engines having characteristics not greatly different from those of existing



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types, fan cooling may become necessary and does not appear to be inconsistent with the use of ring cowling of the Townend type.

Assuming a mean temperature difference of 250 deg. C. between cylinders and cooling air, McKinnon Wood estimates that, allowing for fan losses, 4 per cent. of the b.h.p. will be used in providing cylinder cooling alone. A mean temperature of 250 deg. C. between cylinders and air is certainly not available in the majority of engines to-day in service. The maximum permitted temperature at a position on the cylinder heads, which is certainly above the mean temperature of the cylinders as a whole, is normally between 215 deg. and 235 deg. C. For a mean temperature difference of 200 deg. C., McKinnon Wood gives the power absorbed in cooling cylinders as 10 per cent. of the b.h.p. Even 200 deg. C. is almost certainly higher than the mean difference which can be permitted with engines of existing type, but we may take this figure of 10 per cent. as representing about the figure which might be achieved in practice with a cooling system of the type suggested.

The best result within my knowledge which has so far been obtained, using a Townend Ring, is that given by 54-in. diameter nine-cylinder radial engine mounted on a streamline nacelle of 42-in. maximum diameter, fitted with a polygonal Townend Ring, and having a total drag at 100 ft./sec. of 27 lb. This result has already been referred to (Fig. 12).

With an engine developing the maximum b.h.p. of 480 at 4,000 ft., the speed of the aircraft fitted with this installation was 140 m.p.h. true (132 i.a.s. at 4,000 ft.), and the power absorbed by a resistance of 27 lb. at 100 ft./sec. at this speed is 43.5 h.p., or 9 per cent. of the engine b.h.p. When an engine of the same overall dimensions and type, but supercharged to give 600 h.p. at 5,500 ft., was fitted in place of the lower-powered engine, the speed of the aircraft increased to 160 m.p.h. true (148 m.p.h. indicated at 5,500 ft.), the engine installation drag being unaltered, and the power absorbed in overcoming engine drag became 54 h.p.—still 9 per cent. of the total.

Allowing for airscrew efficiency, the drag of the engine installation in this case at top speed is about 11.5 per cent. of the total drag of the aircraft.

I understand that Messrs. Armstrong Siddeley Motors, Ltd., have measured a total drag of 35 lb. at 100 ft./sec. for the fuselage, engine and Townend Ring of a military machine with open cockpit, wind screen and pilot. The engine in this case was a "Jaguar" capable of developing about 500 h.p. at sea level. This is 8 lb. in excess of the nacelle figure above quoted, and it is certainly not to be expected that the resistance of the fuselage alone, engine removed and a faired nose substituted, could reach so small a figure as this. The drag to be attributed to the engine in this case must therefore have been less than in the examples which I have considered.

## EVAPORATIVE COOLING

By R. HALEY\*

EVAPORATIVE cooling in aircraft engines has undoubtedly made great progress in the past five years, and the attempt to improve the efficiency of the air-cooled engines by the addition of the Townend Ring and others has no doubt hastened the efforts of the water-cooled engine manufacturers to improve their system of cooling.

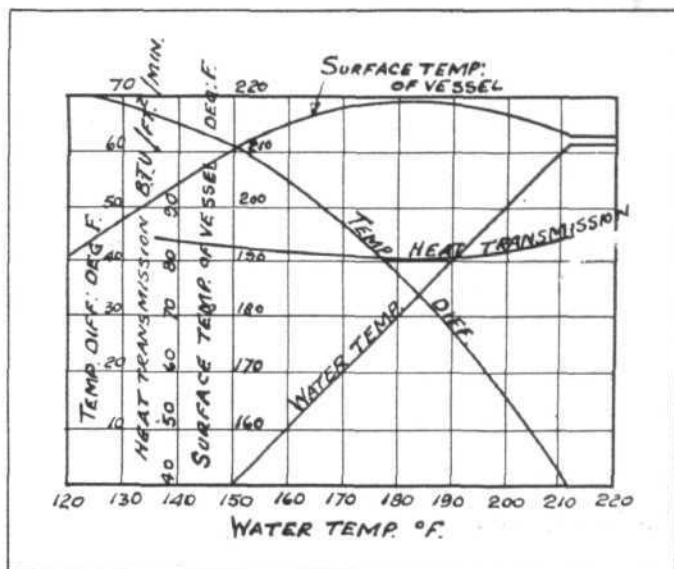


Fig. 1 : Professor Gibson's Experiment.

A practical method has been developed for increasing the capacity of a cooling fluid for heat dissipation by using the latent heat of vaporisation.

The greatest difficulty to be overcome on any type of I.C. engine is to keep the working temperature level. Temperatures should be kept high, but within the limits of effective lubrication. The most desirable condition is a uniform high temperature, in all parts of the engine. That is to say, an important feature of the cooling system is to keep the engine hot.

In an aircraft installation, fitted with evaporative cooling, the control of temperature, external to the system, is of course impossible, due to varying conditions of flight, but some form of control over the cooling system fitted is necessary, and the method adopted will be described later.

In this country the cooling system is vented to the atmosphere, but in America they are using successfully an unvented system, i.e., a pressure gauge is fitted, set to 5 lb. per sq. in.

Before describing the layout of an evaporative cooled system it will be interesting to note the results of certain experiments carried out by Prof. Gibson in 1910 and reported to the Institute of Engineers and Ship-builders.

The tests consisted of measuring the surface temperature of an iron vessel in which water was heated by a gas flame. The water was vigorously stirred during the experiment, and it was found that the temperature of the surface actually decreased as boiling point was reached.

Fig. 1 shows graphically, on a base of water temperatures, the results he obtained. As the temperature of the water increased, that of the vessel increased

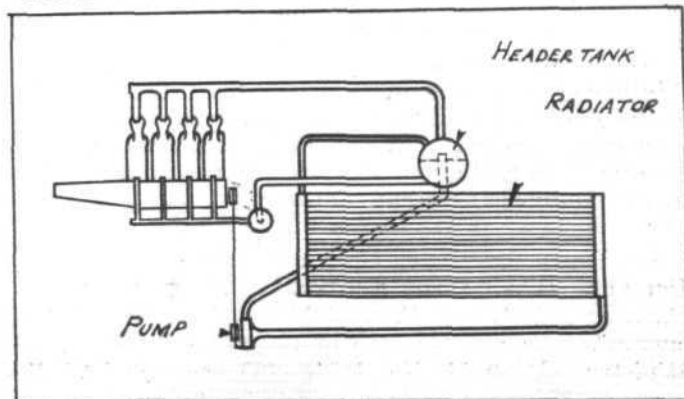


Fig. 2 : Diagram of the Antoinette cooling system.

\* Mr. Haley is on the Technical Staff of the Gloster Aircraft Co., Ltd.

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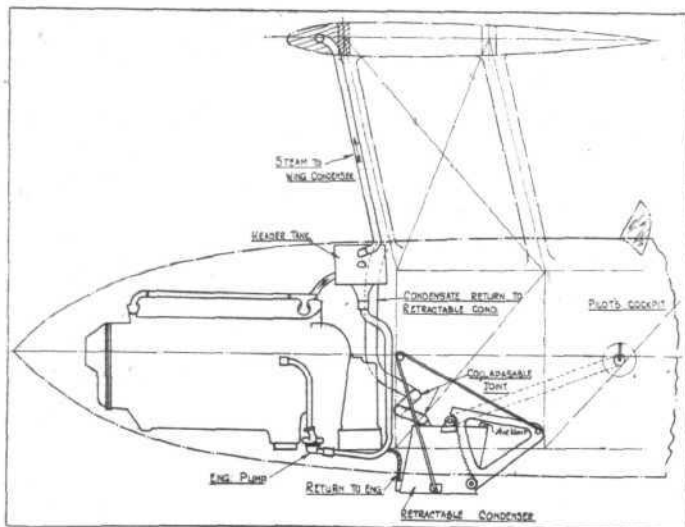


Fig. 3 : Diagrammatic representation of present British system

also. This continued only until the water had reached 180 deg. F.; after that there was a gradual decrease in the temperature of the vessel. There was, as boiling point was approached, a corresponding increase in the rate of transmission of heat. This indicates that one need not fear overheating of an I.C. engine when using the evaporative system of cooling.

Fig 2 shows a diagram of the early Antoinette cooling system, designed by the well-known French designer Levavasseur.

Fig. 3 shows diagrammatically the present system of evaporative cooling in this country. The steam from the cylinder jacket passes into a "header tank," wherein the moisture from the steam is separated and adds to the water already in the tank. The dry steam then passes up to the wing condensers, the condensate being returned to the cylinder jacket via the circulating pump. Due to the fact that the condensers could not cope with the varying rise and fall of temperature under varying conditions of flight, it was found necessary to have some means of controlling the amount of cooling within reasonable limits. To do this a honeycomb radiator was mounted under the fuselage and a mechanical means of raising and lowering same by the pilot was installed. Readers will be familiar with a typical example in the Hawker "Hart" published in FLIGHT. The condensate and uncondensed steam is taken from the wing condensers and passes through the bottom radiator, where it is finally condensed and cooled before returning to the cylinder water jacket.

(To be continued.)

## TECHNICAL LITERATURE

### SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C.2; 120, George Street, Edinburgh; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; 15, Donegall Square West, Belfast; or through any Bookseller.

**TORSIONAL RESONANCE CHARACTERISTICS OF A TWELVE-CYLINDER VEE AERO ENGINE.** By B. C. Carter, F.R.Ae.S., M.I.Mech.E., and N. S. Muir, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1304. (39 pages and 37 diagrams.) February 2, 1933. Price 3s. net.

In a number of Service Liberty engines, fatigue cracks developed at the fillet between the fifth crankpin from the tail end of the crankshaft and the

ninth web. Torsiograph tests revealed that torsional vibration was an important contributory cause of these failures and yielded data for an investigation of damping. The torsiograph investigations are described in this report in conjunction with frequency calculations and consideration of minor criticals. Also, a general analytical method of investigating damping in multi-crank engines is set out and applied to the Liberty engine to obtain damping factors for use in assessing the severity of important criticals in proposed designs for new engines.

The crankshaft-aircrew system has been reduced to an equivalent dynamical system and the natural frequency of single node torsional vibration calculated. The relative importance of the several orders of vibration, for the same forcing torque and damping, has been estimated, and the effects on the magnitude of the vibrations that would result from increasing the Vee angle from 45 deg. to 60 deg. have been examined.

Using the R.A.E. torsiograph, series of torsiograms have been obtained from a Liberty engine driving an airscrew at various speeds up to 2,000 r.p.m. The actual torque variations have been determined from static calibration of the torsiograph as fitted.

The specific conclusions relate mainly to the Liberty engine, but they serve to indicate the characteristics of similar engines.

The most important torsional vibration in the operating speed range occurs at 1,300 r.p.m. and is of  $4\frac{1}{2}$  order with a single node near the airscrew.

Torsional vibration can be considered as producing additional stress variations which increase in range towards the airscrew end of the shaft, where the single node occurs. Thus, failure at the fifth crank from the free end is consistent with pronounced but not extreme single-node torsional vibration.

The severity of any critical is greatly dependent upon the Vee angle. For example, if this angle were 60 deg. (instead of 45 deg.), the forcing harmonic of the  $4\frac{1}{2}$  order critical would be 28 per cent. less and that of the 6th order critical would be 41 per cent. greater. With an 80 deg. Vee the  $4\frac{1}{2}$  order critical would be zero, assuming uniform cylinder performance.

The damping appears to be proportional to the third power of the stress amplitude instead of to the second power as for viscous friction damping. The total mechanical hysteresis in the crankshaft material, as derived from data given by Dorey for pure stress reversal (Reference 10), accounts for only a small fraction of the damping present.

Aerodynamic damping for a rigid airscrew is readily calculated and in this instance it is negligibly small.

**METHODS OF VISUALISING AIR FLOW WITH OBSERVATIONS ON SEVERAL AEROFOILS IN THE WIND TUNNEL.** By K. W. Clark, B.Sc., D.I.C. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1552. (10 pages and 22 diagrams.) May 8, 1933. Price 1s. net.

During tests and research work carried out in the wind tunnels it is often desirable to be able to see the air flow over the body, and to know its direction and whether it is turbulent or not. The following is a brief discussion of some of the methods in use, considered primarily as an aid to general work at the higher speeds. They include (1) attaching fine tufts of silk to the surface; (2) the use of a pencil of dense smoke; (3) heating the air stream locally by electric sparks or an electrically-heated fine wire; and (4) changing the colour of the surface in the wake of the flow.

Tufts provide most information and are simplest and quickest to use. The use is for flow near the surface and is complementary to smoke or heated air methods of visualising the flow above the surface. The observations show that whereas the initial stages of the breakdown in flow and the final stalled condition show marked similarities for all the aerofoils there is an intermediate stage in which the differences between the aerofoils are very noticeable.

**THE BUCKLING OF THIN PLATES IN COMPRESSION.** By H. L. Cox, B.A. Work performed for the Aeronautical Research Committee. R. & M. No. 1554. (21 pages and 8 diagrams.) August, 1933. Price 1s. 3d. net.

The strength of constructions in thin sheet metal that are now being used to a large extent by aircraft manufacturers, is often very considerably affected by instability of parts of the structure. The present paper describes an investigation by both theoretical and experimental methods into the influence of buckling on the strength of rectangular plane panels of thin sheet metal subjected to compression parallel to one pair of edges.

Theoretical analysis of the behaviour of panels both before and after buckling is developed and the results are compared with the results of tests on panels with two different types of edge support.

The results of the experiments carried out to check the theoretical conclusions provide reasonable confirmation of the relation between stress and strain as determined theoretically. The collapsing load of a panel of width  $2d$ , thickness  $2h$  and height greater than  $4d$  is shown theoretically to be equal to the crushing load of a similar panel of width  $2d'$  where  $d' = Lh + Md$ , the values of  $L$  and  $M$  depending upon the crushing strength of the material and upon the edge fixing conditions, and the term  $Lh$  being normally considerably greater than the term  $Md$ . The collapsing loads recorded in actual tests are shown to be in reasonably good agreement with this theoretical formula.

#### ABSTRACT.

**A SURVEY OF THE AIR CURRENTS IN THE BAY OF GIBRALTAR IN 1929-30.** By J. H. Field, C.S.I., M.A., and R. Warden, Ph.D., M.Eng. R. & M. No. 1563. (3 pages and 1 diagram.) November, 1933. Price 6d. net.

Accidents to naval aircraft in lee of the Rock of Gibraltar led to a survey in 1929-30 of the winds causing them, and the survey included a preliminary examination with a model of the Rock on the scale 1/5,000 in a wind tunnel at the N.P.L., and full-scale work in Gibraltar Bay with pilot balloons and theodolites, and with kites carrying a new form of recording instrument.

It was found that the measurements with the model closely forecast what occurred in nature at Gibraltar in regard to wind directions and the distribution of vortices and vertical currents. The inference follows that model measurements would in future cases be a good preliminary, when the suitability of a proposed aerodrome or sea base is to be considered.

The present paper has been published in full as No. 59 of the Geophysical Memoirs of the Meteorological Office.